

Cumbria County Council

**Minerals and Waste Development Framework
Strategic Flood Risk Assessment (SFRA)**

October 2007



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EXECUTIVE SUMMARY

Introduction

1. The Cumbria Minerals and Waste Development Framework (MWDF) is being developed by Cumbria County Council to secure more sustainable ways of meeting mineral demands and waste management to the year 2018. The framework covers the entire area of Cumbria, *excluding the Lake District National Park*.
2. A number of the minerals extraction and waste sites being considered for allocation as part of the MWDF are at risk of flooding. Under Planning Policy Statement (PPS) 25: Development and Flood Risk, Cumbria County Council has an obligation to review their emerging planning framework in light of this risk, assessing the possible constraints that flooding may place upon County based planning related decisions.

Why carry out a Strategic Flood Risk Assessment (SFRA)?

3. Flooding can result not only in costly damage to property, but can also pose a risk to life and livelihood. It is essential that future development is planned carefully, steering it away from areas that are most at risk from flooding, and ensuring that it does not exacerbate existing flooding problems.
4. *Planning Policy Statement (PPS) 25: Development and Flood Risk* has been developed to underpin decisions relating to future development within areas that are subject to flood risk.
5. In simple terms, PPS25 requires local planning authorities to review the variation in flood risk across their district, and to steer vulnerable development towards areas of lowest risk.
6. Where this cannot be achieved and development is to be permitted in areas that may be subject to some degree of flood risk, PPS25 requires the Council to demonstrate that there are sustainable mitigation solutions available that will ensure that the risk to property and life is minimised (throughout the lifetime of the development) should flooding occur.
7. The Strategic Flood Risk Assessment (SFRA) is the first step in this process, and it provides the building blocks upon which the Council's planning and development control decisions will be made.

What is involved in a Strategic Flood Risk Assessment (SFRA)?

8. The Cumbria MWDF Strategic Flood Risk Assessment (SFRA) has been carried out to meet the following key objectives:
 - **Collate all known sources of flooding** - including river, surface water (local drainage), sewers and groundwater, which may affect existing and/or future development within the County.
 - **Identify areas that have a 'low', 'medium' and 'high' probability of flooding** -in accordance with Planning Policy Statement 25 (PPS25).
 - **Recommend appropriate land uses within flood affected areas** - in accordance with the PPS25 Sequential Test that will not unduly place people or property at risk of flooding.
 - **Recommend possible flood mitigation solutions** - that may be integrated into the design (by the developer) in areas where flood risk has been identified as a potential constraint to future development, to minimise the risk to property and life should a flood occur (in accordance with the PPS25 *Exception Test*).

The Sequential Test

9. PPS25 advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites). In simple terms, this requires planners to seek to allocate sites for future development within areas of lowest flood risk in the initial instance.
10. Only if it can be demonstrated that there are no suitable sites within these areas should alternative sites (i.e. within areas that may potentially be at risk of flooding) be contemplated. This is referred to as the Sequential Test.
11. As an integral part of the sequential approach, PPS25 stipulates permissible development types. This considers both the degree of flood risk posed to the site, and the likely vulnerability of the proposed development to damage should a flood occur.
12. The PPS25 Sequential Test is depicted in Figure 3.1 of the Practice Guide Companion to PPS25 (Draft, February 2007) and Section 6.4.1 of this document.

The Exception Test

13. Many towns within England are situated adjacent to rivers, and are at risk of flooding. The future sustainability of these communities relies heavily upon their ability to grow and prosper. It is recognised that in some areas, restricting certain types of waste management facilities from areas designated as Zone 3a High Probability may have a detrimental impact upon the existing communities and the environment.
14. For this reason, PPS25 provides an Exception Test. Where a planning authority has identified that there is a strong planning based argument for a development to proceed that does not meet the requirements of the Sequential Test, it will be necessary for the Council to demonstrate that the Exception Test can be satisfied.
15. For the Exception Test to be passed it must be demonstrated that:
 - *“...the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the Development Planning Document (DPD) has reached the ‘submission’ stage, the benefits of the development should contribute to the Core Strategy’s Sustainability Appraisal;*
 - *the development should be on developable, previously developed land or if it is not on previously developed land, that there are no reasonable alternative sites on previously developed land; and*
 - *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.”*

Outcomes of the Cumbria MWDF SFRA

16. Cumbria has been delineated into zones of low, medium and high probability of flooding, based upon existing available information provided by the Environment Agency. Detailed flood risk mapping has been made available for several of the principal rivers in the County. The Environment Agency Flood Zone Maps (April 2007) have been adopted as the basis for the SFRA for other watercourses.
17. The spatial variation in flood risk across the County has been delineated in the following manner:

Zone 3b (Functional Floodplain)

18. Areas subject to flooding up to (and including) once in every 20 years on average have been identified as Zone 3b Functional Floodplain. These areas are subject to relatively frequent flooding, which may include fast flowing and/or deep water. Whilst it may be impractical to refuse all future development within some of these areas (especially those which are already developed), careful consideration must be given to future sustainability.

Zone 3a High Probability

19. Areas subject to flooding up to (and including) once in every 100 years on average (i.e. Zone 3a High Probability) have been identified. Sites handling hazardous waste and landfill sites should be avoided in these areas wherever possible. It is recognised however that in some instances there may be strong planning arguments as to why they may be required in these areas.
20. To meet the requirements of the Exception Test therefore, it will be necessary for the Council to demonstrate that the development provides wider sustainability benefits to the community that outweigh flood risk. The Council must also demonstrate that the development is on developable, previously developed land or if it is not on previously developed land, that there are no reasonable alternative sites on previously developed land.
21. The SFRA has outlined specific development control conditions that should be placed upon development within Zone 3a High Probability to minimise both the damage to property, and the risk to life in case of flooding. It is essential that the developer carries out a detailed Flood Risk Assessment to consider the site-based constraints that flooding may place upon the proposed development.

Zone 2 Medium Probability

22. Areas subject to flooding in events exceeding the 100 year event, and up to (and including) once in every 1000 years on average (i.e. Zone 2 Medium Probability) have been identified. There are generally no restrictions placed upon the allocation of minerals and waste sites in these areas, however it is important to ensure that the developer takes account of possible climate change impacts to avoid a possible increase in the risk of flooding in future years (achieved through completion of a simple Flood Risk Assessment).

Zone 1 Low Probability

23. There are no restrictions placed on development within Zone 1 Low Probability (i.e. all remaining areas of the County). It is important to remember however that development within these areas, if not carefully managed, may exacerbate existing flooding and/or drainage problems downhill. It is necessary therefore to ensure that developers carry out a Drainage Impact Assessment. This should demonstrate that the proposed drainage system design will mitigate any possible increase in runoff that may occur from the site as a result of the proposed development.

The Way Forward

24. Several areas are at risk of flooding across the County. The risk of flooding posed arises from a number of sources including river and coastal flooding and localised run-off.
25. A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test.
26. Where other planning considerations must guide the allocation of sites and the Sequential Test cannot be satisfied, specific recommendations have been provided to assist the Council and the developer to meet the Exception Test. These should be applied as

development control conditions for all future development. It is essential that these are applied, not only where there is a direct risk of flooding to the proposed development site, but elsewhere within the County. It is important to recognise that all development may potentially have an adverse impact upon the existing flooding regime if not carefully mitigated.

27. It is essential that Cumbria County Council policy ensures that the recommended development control conditions are imposed consistently at the planning application stage. This is needed to achieve future sustainability within the County with respect to flood risk management. It is recommended that future revision to MWDF policy is developed in light of the suggested development control conditions presented by the SFRA (refer Section 6.5).

A Living Document

28. The Cumbria MWDF SFRA has been developed in accordance with PPS25. The SFRA has been developed building heavily upon existing knowledge with respect to flood risk within the County. The Environment Agency regularly review and update their Flood Zone Maps (on a quarterly basis) and a rolling programme of detailed flood risk mapping within the North West region is underway. This will improve the current knowledge of flood risk within the County, and may marginally alter predicted flood extents. This may therefore influence future development decisions within these areas.
29. In summary, it is imperative that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives and an improving understanding of flood risk within the County. It is recommended that the SFRA is reviewed on an annual basis during the first quarter of each year (January to March).

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1 Introduction

1.1 Overview

30. The Cumbria Minerals and Waste Development Framework (MWDF) is being developed by Cumbria County Council to secure more sustainable ways of meeting mineral demands and waste management to the year 2018. It covers the entire area of Cumbria, *excluding the Lake District National Park*.
31. A number of the minerals extraction and waste sites being considered for allocation as part of the MWDF are at risk of flooding. Under Planning Policy Statement (PPS) 25: Development and Flood Risk, Cumbria County Council has an obligation to review their emerging planning framework in light of this risk, assessing the possible constraints that flooding may place upon County based planning related decisions.
32. Jacobs was commissioned by the Cumbria County Council in July 2006 to carry out this review, developing a Strategic Flood Risk Assessment (SFRA) that will be submitted as part of the proof of evidence required to support the Cumbria MWDF.
33. It is highlighted that the Cumbria County SFRA is being developed in parallel with a series of local authority based SFRAs for the respective boroughs within the County. These SFRAs are reviewing emerging housing and employment land uses, and these issues will not be considered explicitly within this document. Individual borough wide Strategic Flood Risk Assessments that should be referenced to assess issues relating to housing and employment development within the County include:
 - Allerdale;
 - Barrow in Furness;
 - Carlisle;
 - Copeland;
 - Eden;
 - Lake District;
 - South Lakeland.

1.2 Mineral Extraction & Waste Management in Cumbria

1.2.1 Waste Management

34. Recent changes to government legislation means that the amount of waste going to landfill needs to reduce dramatically. To do this, a number of targets for recycling, composting and other uses have been set. Without adequate waste management facilities, economic growth will be constrained. Industry will face increased costs and Council will be financially penalised for not meeting government targets.
35. Cumbria County Council is planning to invest heavily in new equipment and waste management facilities to allow them to meet these obligations. Consequently, the Council is investigating a number of sites across the County for their suitability for waste management uses.

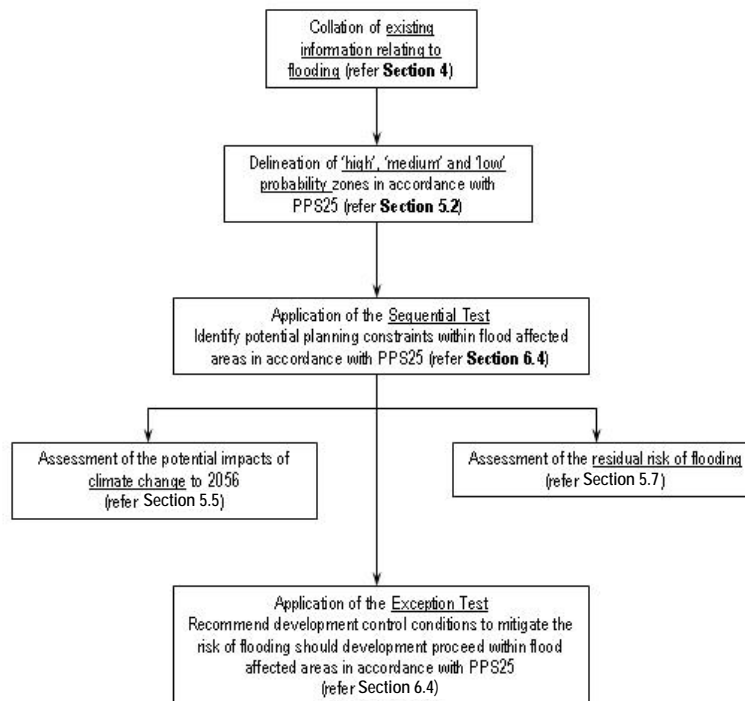
1.2.2 Mineral Extraction

36. Mineral extraction is major industry in Cumbria. It provides jobs in an area of economic decline, plus further employment in associated manufacturing and service industries. Minerals are also used to supply the raw materials used in construction projects across the region.

37. The Council need to balance the need for increasing demand for minerals against the impacts that the works have on the environment and the surrounding population. This SFRA will consider the potential flood risk issues that may arise associated with proposed mineral extraction (including both new sites, and extensions to existing sites). It will also examine the potential impact that the cessation of dewatering may have upon the localised flooding regime.

2 SFRA Approach

38. The primary objective of the Cumbria County Council SFRA is to inform the revision of flood related policies, including the allocation of land for minerals extraction and waste management within the emerging MWDF.
39. The Government provides no specific methodology for the SFRA process. Therefore, to meet these broader objectives, the SFRA has been developed in a pragmatic manner in close consultation with both the Council and the Environment Agency.
40. A considerable amount of knowledge exists with respect to flood risk within the County, including information relating both to historical flooding, and the predicted extent of flooding under extreme weather conditions (i.e. as an outcome of detailed flood risk modelling carried out by the Environment Agency). The Cumbria County Council SFRA has built heavily upon this existing knowledge, underpinning the delineation of the County into zones that have a 'high', 'medium' and 'low' likelihood of flooding, in accordance with PPS25. These zones have then been used to provide a robust and transparent evidence base for the development of flooding related policy, and the future allocation of sites for waste management and mineral extraction uses.
41. A summary of the adopted SFRA process is provided in the figure below, outlining the specific tasks undertaken and the corresponding structure of the SFRA report.



3 Policy Framework

3.1 Introduction

42. A framework of national and regional policy directive is in place, providing guidance and direction to local planning authorities. Ultimately however, it is the responsibility of the Council to establish robust policies that will ensure future sustainability with respect to flood risk. This section provides a brief overview of the strategy and policy context relevant to the MWDF and flood risk in the Cumbria County Council area.

3.2 National Policy

3.2.1 Overview

43. National planning policy is set out through a number of Planning Policy Statements (PPSs) and Planning Policy Guidance Notes (PPGs). The Government is currently reviewing all PPGs with revised advice being set out in a PPS and, where necessary, accompanying best practice guidance.
44. PPSs and PPGs cover a full range of planning issues drawing on the central issue of sustainable development. Central themes include the re-use of previously developed land and the wish to steer inappropriate (or vulnerable) development away from areas at risk of flooding. It is a requirement that the Cumbria MWDF is consistent with Government planning policy.

3.2.2 Planning Policy Statement (PPS) 25: Development and Flood Risk

45. Planning Policy Statement 25 (PPS25) was released in December 2006, and underpins the process with which local planning authorities are to account for flood risk as an integral part of the planning process. The over-arching principles set out by PPS25 for the management of flood risk at a planning authority level are encapsulated in Paragraph 6 of the document:

“Regional planning bodies (RPBs) and local planning authorities (LPAs) should prepare and implement planning strategies that help to deliver sustainable development by:

Appraising risk

- *identifying land at risk and the degree of risk of flooding from river, sea and other sources in their areas;*
- *preparing Regional Flood Risk Appraisals (RFRA) or Strategic Flood Risk Assessments (SFRAs) as appropriate, as freestanding assessments that contribute to the Sustainability Appraisal of their plans;*

Managing risk

- *framing policies for the location of development which avoid flood risk to people and property where possible, and manage any residual risk, taking account of the impacts of climate change;*
- *only permitting development in areas of flood risk when there are no reasonably available sites in areas of lower flood risk and benefits of the development outweigh the risks from flooding;*

Reducing risk

- *safeguarding land from development that is required for current and future flood management, e.g. conveyance and storage of flood water, and flood defences;*
- *reducing flood risk to and from new development through location, layout and design, incorporating sustainable drainage systems (SUDS);*
- *using opportunities offered by new development to reduce the causes and impacts of flooding, e.g. surface water management plans; making the most of the benefits of green infrastructure for flood storage, conveyance and SUDS; re-creating functional floodplain; and setting back defences;*

A partnership approach

- *working effectively with the Environment Agency, other operating authorities and other stakeholders to ensure that best use is made of their expertise and information so that plans are effective and decisions on planning applications can be delivered expeditiously; and*
- *ensuring spatial planning supports flood risk management policies and plans, River Basin Management Plans and emergency planning.”*

46. These broad objectives effectively set the scope for the specific outcomes of the SFRA process. The SFRA in turn then informs planning and development control decisions to ensure that the objectives set out above can be achieved. The guidance in PPS25 also indicates that Sustainability Appraisals should be informed by the SFRA for their area.

47. It is important to reiterate that PPS25 is not applied in isolation as part of the planning process. The formulation of Council policy and the allocation of land for minerals and waste sites must also meet the requirements of other planning policy directives. Flood risk is only one factor that will need to be considered by the Council in the wider context of sustainable development. PPS10: Planning for Sustainable Waste Management recommends that a Sustainability Appraisal (SA) should be used to shape waste planning strategies. The purpose of SA is to promote sustainable development through better integration of sustainability considerations in the preparation and adoption of plans.

48. The application of differing planning policy guidance may introduce some apparent conflict in national policy direction. Clearly a careful balance must be sought in these instances, and the SFRA aims to assist in this process through the provision of a clear and robust evidence base upon which informed decisions can be made.

3.2.3 Minerals Policy Statement (MPS) 1: Planning and Minerals

49. Minerals Policy Statements (MPSs) was released in November 2006. It sets out the Government's national planning policies for minerals planning in England. These complement, but do not replace or overrule, other national planning policies, and should be read in conjunction with other relevant statements of national planning policy. MPS1 sets out the Government's key overarching policies and principles which apply to all minerals¹.

50. The policy statement contains the following text in relation to flood risk:

“To achieve the objectives and measures set out above, RPBs, MPAs and LPAs should carry out their functions in relation to the preparation of plans and in relation to development control, in accordance with the national policies for minerals planning set out below:

- *ensure, in association with the Environment Agency, that in areas at risk of flooding, mineral extraction proposals do not have a significant adverse impact on flood flows or flood storage capacity. Operators should demonstrate that mineral working should not materially increase the risk of flooding at other*

¹ Minerals Policy Statement 1 (November 2006), page 3, Department for Local Government and Communities

properties or locations and, where practicable, should increase flood storage capacity;

- *ensure that proposals for mineral extraction and the storage and tipping of mineral wastes are designed, and appropriate monitoring procedures set up, to ensure that the operation and restoration of the site does not create land instability and help prevent pollution of soil, air, surface water and groundwater;*
- *ensure that proposals for mineral extraction from coastal cliffs, beaches and dune systems do not adversely affect the stability of the coastal environment, increase the rate of coastal erosion or vulnerability to flooding, or affect sensitive habitats, landscapes or Heritage Coasts.”*

3.3 Regional Planning Policy

3.3.1 Regional Planning Guidance for the North West (RPG13)

51. Regional planning policies provide the overarching framework for the preparation of the LDF. Regional Planning Guidance for the North West (RPG13) covers the period up to 2021, and sets out the housing requirement for each county within the region. It was adopted in March 2003.
52. Under new Government legislation, it is to be replaced a new type of document, which requires a Regional Spatial Strategy to be prepared for each region of England. The document for the North West is known as the North West Plan.

3.3.2 The North West Plan

53. The North West Plan has been prepared by the North West Regional Assembly (NWRA) and was submitted to the Government in Jan 2006. It sets out the out the framework for the future development of the North West of England through to 2021. Following a Government and public review, the final version of the North West Plan is expected to be published in late 2007.
54. The regional planning policies that relate to flood risk are:

Policy DP1 - Regional Development Principals

As an urgent regional priority, plans and strategies should identify, assess and apply measures to ensure effective adaptation to the likely environmental, social and economic impacts of climate-related changes. And: Proposals and schemes must take into account the local implications of climate change, particularly in vulnerable areas, coastal zones and locations at risk of flooding.

3.3.3 The Cumbria and Lake County Joint Structure Plan

55. The Cumbria and Lake County Joint Structure Plan is a statutory document which provides a strategy and policies for the development and use of land within Cumbria, including the Lake County National Park but excluding the Yorkshire Dales National Park. The aim of the Structure Plan is to secure a more sustainable pattern of development, reflecting the Government’s sustainable development objectives.
56. A number of policies within the document contain statements that apply to flood risk. Including:

“Policy ST3: Principles applying to all new development

All proposals for development including alterations to existing buildings and land use change will be required to reduce the risk of flooding within the development and elsewhere by a choice of location in the following order of priority:

- a. sites with little or no flood risk, followed by*
- b. sites with low or medium flood risk, and only then*
- c. sites in areas of high flood risk.*

Design proposals should minimise or mitigate any flood risk and where practicable include sustainable drainage systems.

Policy C42: Flood risk and development

Development proposals should take into account an assessment of the risk of flooding and be in accordance with the search sequence outlined in Policy ST3. Development will not be permitted on functional floodplains within areas with a high risk of flooding, except for essential transport and utilities infrastructure that cannot be located elsewhere, including port related development. Land use changes not requiring built development may be permitted provided adequate warning and evacuation procedures are in place, and existing buildings incorporate floodproofing measures. Elsewhere development that reduces flood risk or aids the operation of functional floodplains will be supported.

Policy C43: Coastal and flood defence

Development proposals should take into account the sustainable planning and management of coastal and flood defences. Development should:

1. *have regard to:*
 - a. *Flood risk statements and assessments,*
 - b. *Indicative Flood Plain and Flood Zone Maps,*
 - c. *Coastal Habitat Management Plans*
 - d. *Shoreline Management Plans and Coastal Defence Strategies*
 2. *avoid areas of flood risk, coastal erosion and unstable land, not prejudice coastal or flood defences, nor the ability of operating authorities to maintain them, or the capacity of the coast to form a natural sea defence or to adjust to changes, without endangering life or property, and*
 3. *be allowed to relocate from areas of the coast that cannot be sustainably defended in the long term.*
57. Council policy is essential to ensure that the recommended development control conditions can be imposed consistently at the planning application stage. This is essential to achieve future sustainability within the County with respect to flood risk management. Cumbria County Council should ensure specific policies are in place relating to mineral extraction and waste management which reduce the potentially adverse impacts of these activities on groundwater and surface water conditions.

4 Data Collection

4.1 Overview

58. A considerable amount of knowledge exists with respect to flood risk within the Cumbria County, including (but not limited to):
- Historical river flooding information;
 - Information relating to localised flooding issues (surface water, groundwater and/or sewer related), collated in consultation with the Council and the Environment Agency;
 - Detailed flood risk mapping;
 - Environment Agency Flood Zone Maps (September 2006);
 - Topography (LiDAR).
59. All of this data has been sourced from the Council and the Environment Agency, forming the core dataset that has informed the SFRA process. The application of this data in the delineation of zones that have a 'high', 'medium' and 'low' probability of flooding, and the formulation of planning and development control recommendations, is explained in Section 5 below. An overview of the core datasets, including their source and their applicability to the SFRA process, is outlined below.

4.2 Environment Agency Flood Zone Maps

60. The Environment Agency's Flood Zone Map shows the natural floodplain, ignoring the presence of defences, and therefore areas potentially at risk of flooding from rivers or the sea. The Flood Map shows the area that is susceptible to a 1 in 100 (1% annual exceedance probability or AEP) chance of flooding from rivers in any one year. It also indicates the area that has a 1 in 1000 (0.1% AEP) chance of flooding from rivers and/or the sea in any given year. This is also known as the Extreme Flood Outline.
61. The Flood Zone Map outlines have been produced from a combination of a national generalised computer model, more detailed local modelling (if available), and some historic flood event outlines. The availability of detailed modelling for the Cumbria area is further discussed in Section 4.4. The Environment Agency's Flood Zone Map provides a consistent picture of flood risk for England and Wales.
62. The Environment Agency's knowledge of the floodplain is continuously being improved by a variety of studies, detailed models, data from river flow and level monitoring stations, and actual flooding information. They have an ongoing programme of improvement, and updates are made on a quarterly basis.

4.3 Historical Flooding

63. Cumbria has a considerable history of flooding with significant events (resulting in property flooding) occurring at several locations a number of times.
64. The flood extents for previous river and tidal flooding events were provided by the Environment Agency and the Council. These outlines are limited in their usefulness for SFRA purposes as the magnitude of the mapped event is not known with a great deal of accuracy. They provide a good depiction of known flood risk areas within the County however, and have been used to review the delineation of the adopted flood risk zones.

4.4 Detailed Hydraulic Modelling

65. A number of detailed flooding investigations have been carried out by the Environment Agency throughout the County of Cumbria. These studies generally incorporate the development of a detailed hydraulic model, providing a more robust understanding of the localised fluvial flooding regime in line with Section 105 (2) of the Water Resources Act.
66. Where available, the results of detailed hydraulic modelling investigations have been adopted as the basis for a thorough 'sensitivity check' of the Environment Agency FZM. At the time of writing, detailed model outlines were made available for:
- River Eden
 - River Eamont
 - River Kent
 - Black Beck
 - River Ehen
 - River Crake
 - River Derwent
 - River Eea
 - River Brathay
 - River Gowan
67. It should be noted that the detailed hydraulic models developed on behalf of the Environment Agency assume 'typical' conditions within the respective river systems that are being analysed. The predicted water levels may change if the operating regimes of the rivers involved are altered (e.g. engineering works which may be implemented in the future), or the condition of the river channel changes.
68. The flood extents derived from detailed hydraulic models are considered to be more refined and accurate than the existing Flood Zone Maps, and therefore have used to underpin the delineation of flood risk in this Strategic Flood Risk Assessment where available.
69. It is noted that the data collection underpinning the development of this SFRA has focussed upon the local districts of Copeland, Eden District, the Lake District National Park and South Lakeland. This is due to the joint funding approach adopted for the current investigation. The SFRA has reviewed specific recommendations relating to minerals and waste sites within adjoining boroughs (i.e. Carlisle, Allerdale and Barrow and Furness), informed by emerging SFRA's developed specifically for these areas. The flood zone mapping presented within the supporting maps however does not reflect detailed flood outlines (where available) in boroughs outside of the immediate study area in this instance. Rather, reliance has been placed upon the Environment Agency flood zone maps within surrounding boroughs.

4.5 Coastal Flood Risk Mapping

70. The mapping of coastal flood risk across the North West region was undertaken in 2001, assuming the horizontal projection of predicted peak tidal design flood levels, breach analysis (within defended areas), and observed historical flooding. The project was aimed at assessing current day flood risk and it does not make allowances for future sea level rise.
71. The result of the study was the production of the 1 in 200 year flood plain (equivalent to Zone 3a High Probability in PPS25).

4.6 Flood Defences

72. Flood defences are typically raised structures that alter natural flow patterns and prevent floodwater from entering property in times of flooding. They are generally categorised as either 'formal' or 'informal' defences. A 'formal' flood defence is a structure that is maintained. Usually, but not always, it is the Environment Agency who carries out this maintenance, even though in many instances it does not actually own the defence. An 'informal' flood defence is a structure that has often not been specifically built to retain

floodwater, and is not maintained for this specific purpose. Boundary walls and industrial buildings situated immediately adjacent to rivers often act as informal flood defences.

73. A limited number of properties situated immediately adjacent to watercourses and the coast within Cumbria are reliant to some degree upon the presence of localised raised defences and/or constructed barriers to protect against tidal and river flooding. The future sustainability of the area is reliant upon the long term structural and operational integrity of these defences.
74. The Environment Agency, as part of their emerging Catchment Flood Management Plan (CFMP) programme, is reviewing the sustainability of the flood defence system protecting properties subject to flooding from rivers. 'Sustainability' in this context is a consideration of the cost incurred for future maintenance offset against the environmental impacts (and/or benefits) of the defences and the social and economic benefits provided to the communities protected. Similarly, a series of Shoreline Management Plans (SMP) are being developed by local authorities (in cooperation with the Environment Agency) to review the sustainability of coastal defences. The SMP considers not only the susceptibility of property to tidal flooding, but also the risk of erosion to coastal areas.
75. However, it is important to reiterate that the risk of flooding can never be fully addressed. There will always be a residual risk of flooding, due to (for example) a more extreme event, changing climatic conditions, and/or a structural failure of the constructed flood defence system. It is incumbent on both Council and developers to ensure that the level and integrity of defence provided within developing areas can be assured for the lifetime of the development.

4.7 Consultation

76. Consultation has formed a key part of the data collation phase for the Cumbria County Council SFRA. The following key stakeholders have been comprehensively consulted to inform the current investigation:

Cumbria County Council

Consulted to identify areas under consideration for future (or an expansion of) waste management or minerals extraction

Local Authorities

Consulted to identify known (and perceived) areas at risk of flooding

Environment Agency

The Environment Agency has been consulted to source specific flood risk information to inform the development of the SFRA. In addition, the Environment Agency is a statutory consultee under PPS25 and therefore must be satisfied with the findings and recommendations for sustainable flood risk management into the future. For this reason, the Environment Agency has been consulted during the development of the SFRA to discuss potential flood risk mitigation measures and planning recommendations.

United Utilities

United Utilities (UU) is responsible for the management of urban drainage (surface water) and sewerage within the County. The underground drainage systems in many towns and cities of England are being progressively upgraded from the Victorian sewers. However, they often remain under capacity and subject to relatively frequent 'overload' (i.e. resulting in flooding on the surface).

77. All water companies must keep a record of occupied properties which have been subject to sewer flooding. This record is known as the DG5 register. UU was consulted to discuss

the risk of localised flooding associated with the existing drainage/sewer system. General information was provided from the DG5 register, but due to UU's confidentiality policy, detailed information could not be given. Consequently, specific areas at risk of sewer flooding cannot be identified. The Environment Agency² state that between 8% and 10% of flooding in the county is related to sewers.

78. It is highlighted however that issues associated with failures of the underground drainage/sewer systems are typically very localised, resulting in nuisance flooding to one or two properties. Issues of this nature should not preclude development. Furthermore, given that many of the sites under consideration for minerals extraction or waste management are not within dense urban areas, issues of this nature are unlikely to pose a risk to (and/or be impacted by) proposed development within the context of this SFRA.
79. Notwithstanding this, it is always important to ensure that future development does not exacerbate known existing problems. Planning decisions should be made with due consideration to potential sewer capacity problems (to be advised by UU as part of the statutory LDF consultation process), and conditions should be placed upon future development to ensure that these capacity issues are rectified before development is permitted to proceed.

4.8 Topography

80. Within a large proportion of the area, detailed flood risk mapping has been carried out, providing a robust means of delineating zones of 'high', 'medium' and 'low' risk. In areas that have not been modelled to date, and/or in which the detailed modelling results could not be made available, dependence must be placed upon the Environment Agency Flood Zone Map, which in these areas provides a relatively coarse depiction of flood risk, as explained in Section 4.2 above.
81. Given that this is the case, a 'sensitivity' check has been carried out within areas in which detailed modelling is currently not available. The primary purpose of this check is to ensure that the adopted Environment Agency Flood Zone Map is generally representative of anticipated flooding conditions.
82. In simple terms, topography provides the basis for a common sense assessment of predicted flood zone extents. Indeed it is important to ensure that the Environment Agency Flood Zone Map reflects the fact that water flows downhill, and that water levels across the river (i.e. on either bank of the river at the same location) are equal. The Environment Agency LiDAR data has been used to reflect the topography of the County in this instance.

² Scoping Reports for Eden CFMP & Kent and Leven CFMP (2006)

5 Flood Risk in Cumbria

5.1 Overview

83. The Cumbria region covers a geographically large and diverse area which contains sizeable rivers, numerous smaller watercourses and an extensive coastline. Across the county, as in much of the UK, development has taken place in the natural floodplains of these features, taking advantage of the transport links, food and energy they provide.
84. It is important to reiterate that this SFRA is reviewing the potential constraints posed by flood risk upon the establishment and/or expansion of minerals extraction sites and waste management facilities within the County. A number of flooding related considerations arise in this context, including the potential of flooding to the site itself (resulting in possible contamination to waterways and/or costly disruption to operations), and the potential risk that the proposed works may pose to surrounding property. This should be borne in mind when reviewing the risk of flooding within Cumbria as outlined in the following sections.

5.1.1 Fluvial Flooding

85. The largest concentrations of fluvial flood risks tend to be in the flatter, lower parts of the catchments of the bigger rivers. In these areas, large areas of development have been established over time.
86. Although the principal watercourses are the main risks in the County, minor watercourses still pose a significant risk of flooding. These smaller watercourses have a tendency to be culverted through developed areas. Culverts are prone to blockage, collapse and may be hydraulically under capacity. Typically, the flooding from a minor watercourse affects only relatively small numbers of properties in isolated locations.
87. Water levels in the rivers and streams in Cumbria respond rapidly following high rainfall. The small, steep catchments transfer water into the channels quickly, i.e. they are 'flashy'. This means that flood warning times are typically short, between 1 and 2 hours, and harder to predict accurately. Consequently, the future facilities may be caught by surprise, resulting in damages being sustained on a more frequent basis.
88. It is important to recognise that flooding may also affect transportation links, preventing access to food and medicine during extended periods of flooding, and resulting in severe disruption to communities and business.
89. The precise extents of fluvial flooding within County is not known in all locations, and reliance has been placed (through necessity) upon the current Environment Agency flood zone maps in some areas. Whilst somewhat coarse, the flood zone maps do provide a reasonable indication of likely flood risk areas, triggering a more detailed assessment should future development be under consideration.
90. It is essential to recognise that flood risk within the County is not limited solely to flooding of main rivers. There is a risk to properties as a result of groundwater flooding, exacerbated by high river levels. Localised flooding as a result of local catchment runoff and/or sewer system failure following heavy rainfall is also a known risk to properties.

5.1.2 Coastal Flooding

91. Most of the Cumbrian Coast is rural, but several large towns are located there. Large areas of Maryport, Barrow, Whitehaven, Workington and Millom are at risk of tidal flooding.
92. The onset of flooding from the sea can be very rapid (once a defence has failed or been overtopped). Deep fast flowing water can create an extreme hazard. The severity of such

flooding will depend on a number of factors, often in combination: the height of tides; weather systems; wind and wave conditions; topography; the effectiveness of drainage systems; and the condition of flood defences.³

5.1.3 Other Sources of Flooding

93. It is vitally important that planning decisions recognise the potential risk that additional sources of flooding may pose to property, including (for example) groundwater flooding and/or sewer flooding. These potential risks are discussed further in Sections 5.3 to 5.5.

5.2 Delineation of the PPS25 Flood Zones

94. It is emphasised that the **risk** of an event (in this instance a flood) is a function of both the **probability** that the flood will occur, and the **consequence** as a direct result of the flood. PPS25 endeavours to assess the likelihood (or probability) of flooding, categorising the County into zones of low, medium and high probability. It then provides recommendations to assist the Council to manage the consequence of flooding in a sustainable manner.
95. To this end, a key outcome of the SFRA process is the establishment of the Sequential Test in accordance with Appendix D (Table D1) of PPS25. To inform the planning process, it is necessary to review flood risk across the area, categorising the area in terms of the likelihood (or probability) that flooding will occur.
96. The County has been delineated into the flood zones summarised below.

Zone 3b The Functional Floodplain

Areas of the region susceptible to flooding within which “*water has to flow or be stored in times of flood*” (PPS25).

Zone 3a High Probability

Land assessed as having a 1 in 100 or greater annual probability of fluvial flooding in any year (i.e. 1% AEP), and/or land assessed as having a 1 in 200 or greater annual probability of tidal flooding in any year (i.e. 0.5% AEP).

Zone 2 Medium Probability

Land assessed as having between a 1 in 100 (i.e. 1% AEP) and 1 in 1000 (i.e. 0.1% AEP) annual probability of river or coastal flooding in any year.

Zone 1 Low Probability

Land assessed as having a less than 1 in 1000 annual probability of river or coastal flooding in any year (i.e. 0.1% AEP).

97. The delineation of the PPS25 flood zones is discussed in Section 5, and presented in the adjoining Flood Risk Maps.

5.2.1 Delineation of Zone 3b Functional Floodplain

98. Zone 3b Functional Floodplain is defined as those areas in which “*water has to flow or be stored in times of flood*”. The definition of functional floodplain remains somewhat open to subjective interpretation. PPS25 states that “*SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes.*” For the purposes of the Cumbria County Council SFRA, Zone 3b has been defined in the following manner:

³ Planning Policy Statement 25: Development and Flood Risk (2006)

- land where the flow of flood water is not prevented by flood defences or by permanent buildings or other solid barriers from inundation during times of flood;
 - land which provides a function of flood conveyance (i.e. free flow) or flood storage, either through natural processes, or by design (e.g. washlands and flood storage areas);
 - land subject to flooding in the 5% AEP (20 year) flood event (i.e. relatively frequent inundation expected, on average once every 20 years).
99. Within the Cumbria County Council area, this encompasses primarily those low lying areas immediately adjacent to the rivers and watercourse. Any development within these areas is likely to measurably impact upon the existing flooding regime, increasing the severity and frequency of flooding elsewhere.
100. It is emphasised that 'functional floodplain' is typically associated solely with river flooding, and is not commonly considered within areas subject to coastal flooding.

5.2.2 Delineation of Zone 3a High Probability

101. Zone 3a High Probability is defined as those areas of the County that are situated below (or within) the 1% AEP (100 year) fluvial flood extent. It is emphasised that the delineation of Zone 3a High Probability does NOT consider the presence of raised defences. This is because defences do not remove the risk of flooding completely. There remains a risk that the constructed defences may fail, resulting in the rapid inundation of areas behind the defences (refer Section 5.3 below).
102. For planning purposes, the Environment Agency has issued a series of Flood Zone Maps as depicted on the Environment Agency's website (www.environment-agency.gov.uk). In those areas for which detailed flood mapping is not available and/or fit for purpose, the Environment Agency's Flood Zone Maps have been adopted to underpin the SFRA process.
103. At these locations, detailed topography has been used to carry out a 'sensitivity check' of the flood zone maps. This check has sought to ensure that the predicted floodplain extents are sensible in light of surrounding ground levels. The topography has also been used to provide a means of sub-delineating zones of higher risk within Zone 3a High Probability, guiding vulnerable development into areas in which the risk to life can be safely mitigated against.
104. The detailed modelling outputs developed by the Environment Agency, where available, have been adopted for the delineation of Zone 3a High Probability, superseding the current EA Flood Zone Map (September 2006). It is highlighted however that subsequent revisions of the EA web based mapping will incorporate this more detailed information in due course, updating the flood zone map so that it is consistent with the detailed modelled outlines provided.

5.2.3 Delineation of Zone 2 Medium Probability

105. Zone 2 Medium Probability is defined as those areas of the County that are situated between the 0.1% AEP (1 in 1000 year) and the 1% AEP (1 in 100 year) flood extents. In this instance, Zone 2 Medium Probability is defined in accordance with the Environment Agency Flood Zone Map.
106. It is noted that, given the relatively rapid rise in topography at the periphery of the floodplain, the increase in the predicted flood extents between High Risk Zone 3 and Zone 2 Medium Probability is marginal. Consequently, throughout much of the area, the difference in the FZM3 and FZM2 flood extents is limited.

5.2.4 Delineation of Zone 1 Low Probability

107. Zone 1 Low Probability is defined as those areas of the County that are situated above (or outside of) the 0.1% AEP (1000 year) flood extent. For SFRA purposes, this incorporates all land that is outside of the shaded Zone 2 and Zone 3 flood risk areas (as defined above).

5.3 Local Drainage Issues

108. As discussed in Section 4.6, consultation has been carried out with the Environment Agency and the Council to identify known and/or perceived problem areas. These drainage problems may be attributed to inundation from floodwaters from open drains and watercourses and increased overland flow due to development and/or exceptionally wet weather. In some instances these problems may be due to poor maintenance, associated with (for example) culvert blockages. These issues are typically both minor and localised in nature.
109. A number of known localised problems have been identified throughout the County, highlighted as an outcome of flooding experienced by local residents or businesses. It is important to note that many have either subsequently been (or are in the process of being) addressed through maintenance to rectify the problem (e.g. removal of localised blockages), or they fall within the 'high' probability flood zone identified in the adjoining maps. As a result, the management of localised flooding will be an integral requirement of the detailed Flood Risk Assessment (to be completed at the planning application stage).
110. Within the urban centres of the County, it is inevitable that localised flooding problems arising from under capacity drainage and/or sewer systems will occur. Input has been sought from United Utilities to pinpoint known and/or perceived problem areas, however the information provided is very general. Issues of this nature however, in addition to those outlined above, are generally localised problems that can be addressed as part of the development design process. They should therefore not influence the allocation of land for future development.
111. Within the context of the Cumbria County SFRA, it is important that the Council are aware of known issues of this nature to ensure that the proposed mineral and waste sites do not exacerbate existing problems. Strict planning conditions should be adopted to ensure that best practice measures are implemented to mitigate any potential increase in loading upon existing drainage system(s).
112. The Environment Agency strongly advocates the use of Sustainable Urban Drainage Systems (SUDS). A wide variety of SUDS techniques are available (refer Section 6.6.3), potentially providing both water quality and water quantity improvement benefits on a site by site basis throughout the County. Wherever possible, the Council should seek to reduce the rate of runoff from the site to greenfield runoff rates (i.e. the rate of runoff generated from the site assuming an open grassed area). Collectively, the effective application of SUDS as part of all future development will assist in reducing the risk of flooding to the County.

5.4 Groundwater Issues

113. There are no known significant groundwater flooding issues within the Cumbria County Council area. Notwithstanding this however, it is recognised that the risks associated with groundwater flooding are not well understood, and it is important to ensure that future development is not placed at unnecessary risk.
114. In accordance with PPS25, all future development will require an appropriate Flood Risk Assessment (FRA) at the planning application stage, commensurate with the level of flood risk posed to the site. The detailed FRA should incorporate a detailed site based

assessment of the potential risk of groundwater flooding to the site (and/or as a result of dewatering activity as discussed further in Section 5.7). The adopted design should be established accordingly, mitigating both the risk of groundwater flooding to the development itself, and the potential increase in flood risk posed to adjoining properties as a result of the proposed development.

5.5 Climate Change

115. A considerable amount of research is being carried out worldwide in an endeavour to quantify the impacts that climate change is likely to have on flooding in future years. Climate change is perceived to represent an increasing risk to low lying areas of England, and it is anticipated that the frequency and severity of flooding will change measurably within our lifetime.
116. PPS25 (Appendix B) states that a 10% increase in the 1% AEP (100 year) river flow can be expected within the next 20 years, increasing to 20% within the next 100 years. In tidally affected areas within the North West England, an increasing rate of change in predicted sea levels is to be assumed with time, as summarised in the table below.

Recommended Contingency Allowances for Net Sea Level Rise
North West England (applied to 1990 base sea level)
PPS25 (Appendix B) Table B2

1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
2.5mm/yr	7.0mm/yr	10.0mm/yr	13.0mm/yr

117. It is essential that any proposed works consider the possible change in flood risk over the lifetime of the development as a result of climate change. The likely increase in flow and/or sea level should be assessed proportionally to the guidance provided by PPS25 as outlined above. For example, if the proposed lifetime of the development is approximately 50 years, then the impact of a 20% increase in the 1% AEP (100 year) fluvial flow should be considered. The increase in peak design tidal flood levels should be assessed in a similar manner.
118. It is emphasised that the potential impacts of climate change will affect not only the risk of flooding posed to property as a result of flooding, but it will also potentially increase the frequency and intensity of localised storms over the County. This may exacerbate localised drainage problems. It is important therefore that both the site based detailed Flood Risk Assessment and the Drainage Impact Assessment (refer Section 6) take due consideration of climate change.

5.6 Residual Risk of Flooding

119. It is essential that the risk of flooding is minimised over the lifetime of the development in all instances. It is important to recognise however that flood risk can never be fully mitigated, and there will always be a residual risk of flooding.
120. This residual risk is associated with a number of potential risk factors including (but not limited to):
- a flooding event that exceeds that for which the flood risk management measures have been designed;
 - the structural deterioration of flood defence structures (including informal structures acting as a flood defence) over time; and/or
 - general uncertainties inherent in the prediction of flooding.
121. The SFRA process has carried out a review of flood risk within the County in accordance with the PPS25 Sequential Test, identifying a number of areas that fall within Zone 3a High Probability. The modelling of flood flows and flood levels is not an exact science. There are limitations in the methodologies used for prediction, and the models developed are reliant upon observed flow data for calibration, much of which is often of questionable quality. For this reason, there are inherent uncertainties in the prediction of flood levels used in the assessment and management of flood risk.
122. It is difficult to quantify uncertainty. The adopted flood zones underpinning the Cumbria SFRA are based upon the detailed flood mapping where available. Whilst these provide a robust depiction of flood risk for specific modelled conditions, all detailed modelling requires the making of core assumptions and the use of empirical estimations relating to (for example) rainfall distribution and catchment response.
123. Taking a conservative approach for planning purposes, it is understood that the Environment Agency generally adopt a 300mm allowance for uncertainty within areas that have been modelled in some detail. The degree of uncertainty in areas reliant upon the Environment Agency's national generalised computer model will clearly be somewhat higher.
124. It is incumbent on developers to carry out a detailed Flood Risk Assessment as part of the design process. A review of uncertainty should be undertaken as an integral outcome of this more detailed investigation.

5.7 Flood Risks to Mineral Extraction Sites

125. The factors that influence the flood risk posed to mineral extraction workings include:
- Topography
 - Geology
 - Hydrology
 - Hydrogeology
 - Climate
 - Method of extraction
 - Rate of dewatering
 - Method of dewatering
 - Vegetation cover
 - Layout of site

126. Quarries and mineral extraction sites can alter the flooding regime of an area significantly. The impact will differ between sites and locations, and may include:
- changing groundwater flows and responses
 - removal or disruption to surface water features (i.e. rivers, streams flood storage)
 - altering catchment size and shape (i.e. diverting drainage routes)
 - altering run-off rates and surface water storage
 - increasing or reducing river flows (i.e. by dewatering)
 - subsidence, lowering local land levels
127. The effects will also be different depending on the stage in the life-cycle of the site. For example, during operation, when dewatering is carried out, groundwater levels are often kept low. However, when the site ends its life, and dewatering activities cease, groundwater levels can increase back to their natural level. Any development that occurred in the area when groundwater levels were kept artificially low could be placed at risk when ground water levels return to normal.
- 128. The assessment of the level of flood risk posed to and by a mineral extraction site will require a detailed FRA which takes into consideration potential impacts at every stage of the development. This should include the effects to the surrounding area after site reinstatement.**

6 Sustainable Management of Flood Risk

6.1 Overview

129. An ability to demonstrate 'sustainability' is a primary government objective for future development within the UK. The definition of 'sustainability' encompasses a number of important issues ranging broadly from the environment (i.e. minimising the impact upon the natural environment) to energy consumption (i.e. seeking alternative sources of energy to avoid the depletion of natural resources). Of particular importance however is sustainable development within flood affected areas.
130. Recent history has shown the devastating impacts that flooding can have on lives, homes and businesses. A considerable number of people that work within areas that are susceptible to flooding, and property and lives can be placed at risk. Careless development can exacerbate this risk. Careful consideration must be taken of the measures that can be put into place to minimise the risk to property and life posed by flooding. These should address the flood risk not only in the short term, but throughout the lifetime of the proposed development. This is a requirement of PPS25.
131. The primary purpose of the SFRA is to inform decision making as part of the planning and development control process, taking due consideration of the scale and nature of flood risk affecting the County. Responsibility for flood risk management resides with all tiers of government, and indeed individual landowners, as outlined below.

6.2 Responsibility for Flood Risk Management

132. There is no statutory requirement for the Government to protect property against the risk of flooding. Notwithstanding this however, the Government recognise the importance of safeguarding the wider community, and in doing so the economic and social well being of the nation. An overview of key responsibilities with respect to flood risk management is provided below.
133. The Regional Assembly should consider flood risk when reviewing strategic planning decisions including (for example) the provision of future housing and transport infrastructure.
134. The Environment Agency has a statutory responsibility for flood management and defence in England. It assists the planning and development control process through the provision of information and advice regarding flood risk and flooding related issues.
135. The Local Planning Authority is responsible for carrying out a Strategic Flood Risk Assessment. The SFRA should consider the risk of flooding throughout the County and should inform the allocation of land for future development, development control policies and sustainability appraisals. Local Planning Authorities have a responsibility to consult with the Environment Agency when making planning decisions.
136. Landowners & Developers⁴ have the primary responsibility for protecting their land against the risk of flooding. They are also responsible for managing the drainage of their land such that they do not adversely impact upon adjoining properties.

⁴ Referred to also as 'landowners' within PPS25

6.3 Strategic Flood Risk Management - The Environment Agency

6.3.1 Overview

137. With the progressive development of urban areas along river corridors, particularly during the industrial era, a reactive approach to flood risk management evolved. As flooding occurred, walls or embankments were built to prevent inundation to developing areas. Needless to say, construction of such walls should be carefully assessed so that it does not result in the redistribution of floodwater, inadvertently increasing the risk of flooding elsewhere.
138. The Environment Agency (EA) in more recent years has taken a strategic approach to flood risk management. The assessment and management of flood risk is carried out on a 'whole of catchment' basis. This enables the Environment Agency to review the impact that proposed defence works at a particular location may have upon flooding at other locations throughout the catchment.
139. A number of flood risk management strategies are underway within the region, encompassing many of the large river systems that influence flood risk within the Cumbria County Council. A brief overview of these investigations is provided below.

6.3.2 Catchment Flood Management Plan (CFMP)

140. *"One of the Environment Agency's main goals is to reduce flood risk from rivers and the sea to people, property and the natural environment by supporting and implementing government policies.*
141. *Flooding is a natural process – we can never stop it happening altogether. So tackling flooding is more than just defending against floods. It means understanding the complex causes of flooding and taking co-ordinated action on every front in partnership with others to reduce flood risk by:*
- *Understanding current and future flood risk;*
 - *Planning for the likely impacts of climate change;*
 - *Preventing inappropriate development in flood risk areas;*
 - *Delivering more sustainable measures to reduce flood risk;*
 - *Exploring the wider opportunities to reduce the sources of flood risk, including changes in land use and land management practices and the use of sustainable drainage systems.*
142. *Catchment Flood Management Plans (CFMPs) are a planning tool through which the Agency aims to work in partnership with other key decision-makers within a river catchment to explore and define long term sustainable policies for flood risk management. CFMPs are a learning process to support an integrated approach to land use planning and management, and also River Basin Management Plans under the Water Framework Directive.⁵*
143. CFMP's are being developed (at the time of writing) across Cumbria for the following areas/catchments:
- River Derwent
 - River Eden
 - River Kent & Leven
 - South West Lakes

⁵ Catchment Flood Management Plans – Volume 1 (Guidance), Version 1.0, July 2004

6.4 Planning & Development Control

6.4.1 Planning Solutions to Flood Risk Management

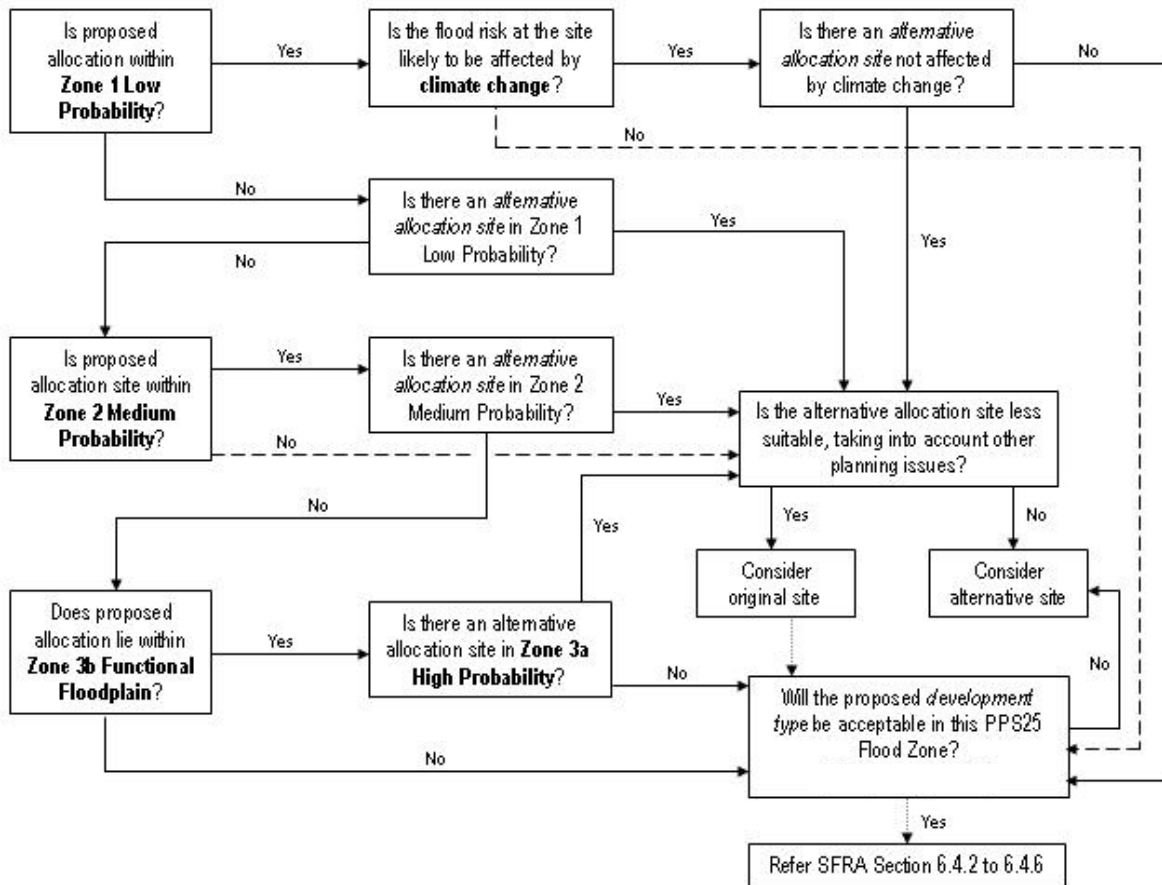
The Sequential Test

144. Historically urbanisation has evolved along river corridors, the rivers providing a critical source of water, food and energy. This leaves many areas of England with a legacy of key urban centres that, due largely to their close proximity to rivers, are at risk of flooding.
145. The ideal solution to effective and sustainable flood risk management is a planning led one, i.e. steer development away from areas that are susceptible to flooding. PPS25 advocates a sequential approach that will guide the planning decision making process (i.e. the allocation of sites).
146. In simple terms, this requires planners to seek to allocate sites for future development within areas of lowest flood risk in the initial instance. Only if it can be demonstrated that there are no suitable sites within these areas should alternative sites (i.e. within areas that may potentially be at risk of flooding) be contemplated.
147. This sequential approach is referred to as **The Sequential Test**. This is summarised in the flow chart following on the following page⁶.

It is absolutely imperative to highlight that the SFRA does not attempt, and indeed cannot, fully address the requirements of the PPS25 Sequential Test. As highlighted in Section 6.4.1 and the flow chart above, it is necessary for the Council to demonstrate that sites for future development have been sought within the lowest flood risk zone (i.e. Zone 1 Low Probability). Only if it can be shown that suitable sites are not available within this zone can alternative sites be considered within the areas that are at greater risk of possible flooding (i.e. Zone 2, and finally Zone 3).

148. As indicated by the bottom right hand corner of the flow chart, PPS25 stipulates permissible development types. This considers both the degree of flood risk posed to the site, and the likely vulnerability of the proposed development to damage (and indeed the risk to the lives of people likely to be at the site) should a flood occur.
149. Wherever possible, the Council should restrict development to the permissible land uses summarised in PPS25 Appendix D (Table D2), (Note tables D1, D2 and D3 have been included in Appendix C of this document). This may involve seeking opportunities to 'swap' more vulnerable allocations at risk of flooding with areas of lesser vulnerability that are situated on higher ground.

⁶ Figure 3.1 (Application of the Sequential Test), A Practice Guide Companion to PPS25, Consultation Paper, February 2007



The Exception Test

150. It is recognised that a relatively small proportion of Cumbria is situated within Zone 3a High Probability and there may be alternative locations out of flood risk zones across the County.
151. However, the number of sites suitable for Minerals and Wastes land uses is limited due to other sustainability factors. Therefore, adopting a blanket approach to prohibiting future development in areas is likely to have a detrimental impact upon the existing communities and the environment, potentially resulting in a substantial increase in the distance travelled to deposit waste, and stemming access to value mineral sources.
152. For this reason, there may be instances in which the Sequential Test cannot be met due to other pressing planning considerations. At these locations, it will be necessary for the Council to work through the **Exception Test** (PPS25 Appendix D) where applicable. For the Exception Test to be passed:
 - *“It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the Development Plan Document (DPD) has reached the ‘submission’ stage, the benefits of the development should contribute to the Core Strategy’s Sustainability Appraisal⁷;*
 - *the development should be on developable, previously developed land or if it is not on previously developed land, that there are no reasonable alternative sites on previously developed land; and*
 - *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and where possible, will reduce flood risk overall.”*

⁷ Note that the Sustainability Appraisal is carried under the Town and Country Planning (Local Development) (England) Regulations 2004, and is required for all Local Development Frameworks (LDFs).

153. The first two points set out in the Exception Test are planning considerations that must be adequately addressed. A planning solution to removing flood risk must be sought at each specific location in the initial instance, seeking to relocate the proposed allocation to an area of lower flood risk (i.e. Zone 1 Low Probability or Zone 2 Medium Probability) wherever feasible.
154. The SFRA has been developed in liaison with the Council and the Environment Agency to work through the requirements of the Sequential Test (and, where necessary, the Exception Test) within the County. It will be the responsibility of the developer (in all instances within Zone 3a High Probability and Zone 2 Medium Probability) to develop a detailed Flood Risk Assessment that can demonstrate that the Sequential Test has been applied, and (where appropriate) that the risk of flooding has been adequately addressed in accordance with PPS25.
155. The management of flood risk throughout the County must be assured should development be permitted to proceed, and the SFRA has provided specific recommendations that ultimately should be adopted as planning conditions for all future development. It is the responsibility of the prospective developer to build upon these recommendations as part of a detailed Flood Risk Assessment to ensure that the specific requirements of PPS25 can be met.
156. Specific planning and development control recommendations for future development within the County are presented below. A 'user guide' to assist in the application of the SFRA recommendations is provided in Appendix A.
157. It is highlighted that PPS25 applies equally to both allocated sites identified within the MWDF and sites that may be allocated in the future.
158. **Future planning decisions should consider the spatial variation in flood risk across the County, as defined by the delineated flood zone that applies at the specified site location, and apply the recommendations provided below accordingly.**

6.4.2 Future Development within Zone 3b Functional Floodplain

159. Future development should be restricted to water-compatible uses and essential infrastructure that has to be there (in accordance with PPS25). Sites within Zone 3b Functional Floodplain are suitable for sand and gravel workings only. The extraction of other minerals, and waste management sites, are not appropriate land uses within this zone and should not be permitted.

6.4.3 Future Development within Zone 3a High Probability

160. Future development within Zone 3a High Probability should be restricted to 'less vulnerable' land uses, in accordance with PPS25 (Appendix D) Table D2. Sites within this zone will be suitable for minerals extraction and waste treatment facilities. Landfills (including both domestic and hazardous waste⁸) should not normally be permitted within Zone 3a High Probability. 'More vulnerable' land uses, including landfill sites, should be steered towards zones of lower flood risk (i.e. Zone 2 Medium Probability or Zone 1 Low Probability) within which suitable land may be available.
161. Where non-flood risk related planning matters dictate that 'more vulnerable' (landfill) development should be considered further, it will be necessary to ensure that the requirements of the Exception Test are satisfied. In planning terms, it must be demonstrated that "the development provides wider sustainability benefits to the community that outweigh flood risk", and that "the development is on developable

⁸ Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10

previously developed land, or that there are no reasonable alternative sites on previously developed land". .

162. To satisfy the remaining criteria of the Exception Test, all development within Zone 3a High Probability should be conditioned in accordance with the development control recommendations set out in Section 6.6 below.

6.4.4 Future Development within Zone 2 Medium Probability

163. In accordance with PPS25, sites within Zone 2 Medium Probability are suitable for minerals extraction, waste treatment and waste deposition facilities (including both domestic and hazardous waste). Only installations that require hazardous substances consent⁹ are restricted within Zone 2 Medium Probability, and should be avoided.
164. Where non-flood risk related planning matters dictate that 'highly vulnerable' (installations requiring hazardous substances consent) development should be considered further, it will be necessary to ensure that the requirements of the Exception Test are satisfied. In planning terms, it must be demonstrated that "the development provides wider sustainability benefits to the community that outweigh flood risk", and that "the development is on developable previously developed land, or that there are no reasonable alternative sites on previously developed land". .
165. To satisfy the remaining criteria of the Exception Test, all development within Zone 2 Medium Probability should be conditioned in accordance with the development control recommendations set out in Section 6.6 below.

6.4.5 Future Development within Zone 1 Low Probability

166. There are no flood risk related constraints placed upon future development within Zone 1 Low Probability (in accordance with PPS25). Notwithstanding this, all development should be carefully planned to avoid exacerbating flood risk to adjoining areas, and/or posing a potential risk to the environment. Within 'dry island' areas that are surrounded by a degree of flood risk, effective emergency planning measures should be in place to ensure that the risk to life (i.e. of workers within the site) is minimised in case of flooding.

6.5 Overview of Flood Risk at Proposed MWDF Sites

167. The following table summarises the findings of the assessment of flood risk at the sites provided for consideration. A more detailed overview, including site plans, is provided in Appendix B. A detailed overview has only been produced for those sites in flood risk Zone 2 Medium Probability and higher, or in the vicinity of local watercourses.
168. The only site where a significant issue has been identified is at AL30 (Innovia Wigton). This site is located in Zone 3b Functional Floodplain and is unsuitable for the proposed land use in accordance with PPS25.

⁹ DETR Circular 04/00 – para. 18: Planning controls for hazardous substances

Site	Flood Zone	Site Type	Main Risk
Allerdale			
AL3	3a	Covered Waste Management/Treatment Facility 1.5 to 2ha	Fluvial/Tidal
AL5	3a	Covered Waste Management/Treatment Facility 1.5 to 2ha	Fluvial/Tidal
AL8	1	Covered Waste Treatment Facility up to 4.5ha	Local Watercourse
AL12	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	-
AL17	1	Household Waste Recycling Centre	-
AL18	3a	Covered Waste Management/Treatment Facility 1.5 to 2ha	Fluvial/Tidal
AL19	3a	Covered Waste Management/Treatment Facility 1.5 to 2ha	Fluvial
AL30	3b	Covered Waste Treatment Facility up to 4.5ha	Fluvial
AL31	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	Local Watercourse/Tidal
Barrow			
BA6	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	-
BA23	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	Local Watercourse/Surface Water
Carlisle			
CA1	1	Household Waste Recycling Centre	-
CA2	1	Household Waste Recycling Centre	Local Watercourse
CA6	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	Local Watercourse
CA8	3a	Household Waste Recycling Centre	Fluvial
CA11	3b	Covered Waste Management/Treatment Facility 1.5 to 2ha	Fluvial
CA13	1	Covered Waste Treatment Facility up to 4.5ha	Local Small Watercourse
CA24	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	Local Small Watercourse
CA25	-	-	No location plan
CA26	3a	Not available	Fluvial
CA27	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	-
Copeland			
CO1	1	Household Waste Recycling Centre	-
CO8	3a	Household Waste Recycling Centre	Fluvial/Tidal
CO11	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	Local Watercourse
CO12	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	-
CO13	3a	Covered Waste Management/Treatment Facility 1.5 to 2ha	Fluvial/Tidal
CO28	1	Household Waste Recycling Centre	-
CO29	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	-
Eden			
ED1	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	-
ED2	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	-
ED10	1	Household Waste Recycling Centre	-
ED16	1	Household Waste Recycling Centre	-
South Lakeland			
SL1	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	-
SL11	3a	Household Waste Recycling Centre	Fluvial/Tidal
SL23	1	Covered Waste Management/Treatment Facility 1.5 to 2ha	-
Mineral Sites			
M5	1	Mudstone	Local Watercourse
M6	1	Sand & Gravel	-
M7	1	Sand & Gravel	-
M8	3a	Sand & Gravel	Fluvial
M9	1	Crushed Rock	-
M10	1	Crushed Rock	Local Watercourse
M11	3a	Sand & Gravel	Fluvial
M12	1	Sand & Gravel	-
M13	1	Crushed Rock	-
M14	1	Slate	-
M15	1	Sand & Gravel	-
M16	1	Crushed Rock	-
M17	1	Crushed Rock	-
M18	1	Gypsum	Local Watercourse

6.6 Detailed Flood Risk Assessment (FRA) – Development Control

6.6.1 Scope of the Detailed Flood Risk Assessment

169. As highlighted in Section 2, the SFRA is a strategic document that provides an overview of flood risk throughout the area. It is imperative that a site-based Flood Risk Assessment (FRA) is carried out for all proposed developments, and this should be submitted as an integral part of the planning application.
170. The FRA should be commensurate with the risk of flooding to the proposed development. For example, where the risk of flooding to the site is negligible (e.g. Zone 1 Low Probability), there is little benefit to be gained in assessing the potential risk to life and/or operations as a result of flooding. Rather, emphasis should be placed on ensuring that runoff from the site does not exacerbate flooding lower in the catchment.
171. It is essential that development control decisions are based upon a robust understanding of the anticipated impacts that the proposed operation may have upon the existing flooding (and flow) regime. For this reason, recommended minimum requirements for proposed minerals extraction and waste management facilities are outlined below¹⁰.
- establish baseline hydrological conditions, within and surrounding a site;
 - establish baseline hydrogeological conditions (minerals sites only), within and surrounding a site
 - identify the potential impacts that the proposed development may have upon groundwater and surface water processes (and conditions) within and surrounding the site, throughout the anticipated lifetime of the operation;
 - identify the likely impact that these potential changes to existing flow regimes may have on water resources, sensitive environments and existing or planned development within adjoining areas;
 - minimise the potential impact upon the environment and adjoining areas through the use of appropriate mitigation techniques, including (for example) the application of sustainable urban drainage systems (SUDS) as outlined in Section 6.6.2 below;
 - monitor groundwater and surface water conditions (i.e. water levels and water quality) throughout the lifetime of the operation;
 - maximise the potential benefits to be gained post cessation from mineral extraction, for example the creation of parks, nature reserves, or voids for landfill;
 - the operator should ensure that there is a dedicated emergency response plan in place during times of flood to ensure that public (worker) safety is not compromised.

6.6.2 Sustainable Urban Drainage Systems (SUDS)

172. SUDS is a term used to describe the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment. The management of rainfall (surface water) is considered an essential element of reducing future flood risk to both the site and its surroundings. Indeed reducing the rate of discharge from urban sites to greenfield runoff rates is one of the most effective ways of reducing and managing flood risk within the County.

¹⁰ Development control recommendations have been taken from the website www.goodquarry.com. This web site has been developed by the University of Leeds and is funded by Defra

173. SUDS may improve the sustainable management of water for a site by¹¹:
- reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
 - reducing volumes and the frequency of water flowing directly to watercourses or sewers from developed sites;
 - improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
 - reducing potable water demand through rainwater harvesting;
 - improving amenity through the provision of public open space and wildlife habitat;
 - replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.
174. In catchment terms, any reduction in the amount of water that originates from any given site is likely to be small. But if applied across the catchment in a consistent way, the cumulative affect of a number of sites could be significant.
175. There are numerous different ways that SUDS can be incorporated into a development and the most commonly found components of a SUDS system are described in the following table¹². The appropriate application of a SUDS scheme to a specific development is heavily dependent upon the topography and geology of the site (and its surrounds). Careful consideration of the site characteristics must be assured to ensure the future sustainability of the adopted drainage system.

SUDS Component	Description
Pervious surfaces	Surfaces that allow inflow of rainwater into the underlying construction or soil.
Green roofs	Vegetated roofs that reduce the volume and rate of runoff and remove pollution.
Filter drain	Linear drains consisting of trenches filled with a permeable material, often with a perforated pipe in the base of the trench to assist drainage, to store and conduct water; they may also permit infiltration.
Filter strips	Vegetated areas of gently sloping ground designed to drain water evenly off impermeable areas and to filter out silt and other particulates.
Swales	Shallow vegetated channels that conduct and retain water, and may also permit infiltration; the vegetation filters particulate matter.
Basins, Ponds and Wetlands	Areas that may be utilised for surface runoff storage.
Infiltration Devices	Sub-surface structures to promote the infiltration of surface water to ground. They can be trenches, basins or soakaways.
Bioretention areas	Vegetated areas designed to collect and treat water before discharge via a piped system or infiltration to the ground
Pipes and accessories	A series of conduits and their accessories normally laid underground that convey surface water to a suitable location for treatment and/or disposal. (Although sustainable, these techniques should be considered where other SUDS techniques are not practicable).

176. For more guidance on SUDS, the following documents and websites are recommended as a starting point:
- Interim Code of Practice for Sustainable Drainage Systems, National SUDS Working Group, 2004
 - Draft Planning Policy Statement 25, Annex F, Office of the Deputy Prime Minister, 2005
 - www.ciria.org.uk/SUDS/

¹¹ Interim Code of Practice for Sustainable Drainage Systems National SUDS Working Group, 2004

¹² Interim Code of Practice for Sustainable Drainage Systems National SUDS Working Group, 2004

6.7 A Living Document

177. The SFRA has been developed in accordance with PPS25. The SFRA has been developed, building upon existing knowledge with respect to flood risk within Cumbria.
178. The Environment Agency regularly review and update their Flood Zone Maps (on a quarterly basis) and a rolling programme of detailed flood risk mapping within the North West region is underway. This will improve the current knowledge of flood risk within the county, and may alter predicted flood extents. The flood extents for different probability flood events could also change over time, due to factors such as climate change and sea level rise. For example, higher river levels as a result of increased rainfall would likely enlarge the area and depth of the 1 in 100 year flood. These factors could therefore influence future planning and development control decisions within these areas.
179. It is imperative that the SFRA is adopted as a 'living' document and is reviewed regularly in light of emerging policy directives and an improving understanding of flood risk. This should specifically include a review of new Flood Zone Maps and detailed modelling outputs produced by the Environment Agency. Appendix D contains recommended key questions that should form part of the review.
180. In order to achieve this, it is recommended that a formal arrangement is adopted between the Environment Agency Area Office (at Penrith) and Cumbria County Council. This arrangement should ensure that any updated detailed modelling flood extents are issued by the Environment Agency and are incorporated into the Local Authorities relevant plans and frameworks as early as possible.

7 Conclusion & Recommendations

181. There is a clear requirement for Cumbria County Council to allocate waste management facilities and mineral extractions sites for the sustainability and economic needs of the County.
182. A considerable proportion of Cumbria is at risk of flooding, including sites being considered for allocation in the MWDF. The flood risk arises from a number of sources including river flooding, coastal flooding, localised runoff, sewer and groundwater flooding.
183. A collation of potential sources of flood risk has been carried out in accordance with PPS25, developed in close consultation with both the Council and the Environment Agency. The County has been broken down into zones of 'high', 'medium' and 'low' probability of flooding in accordance with PPS25, providing the basis for the application of the PPS25 Sequential Test.
184. A planning solution to flood risk management should be sought wherever possible, steering vulnerable development away from areas affected by flooding in accordance with the PPS25 Sequential Test. Specific planning recommendations have been provided for all MWDF sites within the County (refer Section 6.5).
185. Where other planning considerations must guide the allocation of sites and the Sequential Test cannot be satisfied, specific recommendations must be sought to assist the Council and the proposed operator to meet the Exception Test. These should be reviewed in detail as part of the development control process (refer Section 6.6).
186. Council policy is essential to ensure that the recommended development control conditions can be imposed consistently at the planning application stage. This is essential to achieve future sustainability within the County with respect to flood risk management. Cumbria County Council should ensure specific policies are in place relating to mineral extraction and waste management which reduce the potentially adverse impacts of these activities on groundwater and surface water conditions.
187. The core data used to underpin the development of the SFRA will be superseded over time as the Environment Agency provides further investment in detailed modelling of rivers within Cumbria, reviewing its Flood Zone Maps on a quarterly basis. It is recommended that the Environment Agency Flood Zone Maps are retained as the 'first pass' filter at the development application stage, triggering (or otherwise) the need for a more detailed site-based investigation.
188. The SFRA should be retained as a 'living' document, reviewed on a regular basis in light of better flood risk information and emerging policy guidance.

Glossary

AEP	Annual Exceedance Probability e.g. 1% AEP is equivalent to 1% probability of occurring in any one year (or, on average, once in every 100 years)
Core Strategy	The Development Plan Document within the Council's Local Development Framework which sets the long-term vision and objectives for the area. It contains a set of strategic policies that are required to deliver the vision including the broad approach to development.
DCLG	Department of Communities and Local Government
Defra	Department of Environment, Food and Rural Affairs
Development	The carrying out of building, engineering, mining or other operations, in, on, over or under land, or the making of any material change in the use of a building or other land.
Development Plan Document (DPD)	A spatial planning document within the Council's Local Development Framework which set out policies for development and the use of land. Together with the Regional Spatial Strategy they form the development plan for the area. They are subject to independent examination.
DPD	Development Planning Document
EA	Environment Agency
Flood Map	Nationally consistent delineation of 'high' and 'medium' flood risk, published on a quarterly basis by the Environment Agency
Formal Flood Defence	A structure built and maintained specifically for flood defence purposes
Functional Floodplain	PPS25 Flood Zone, defined as areas at risk of flooding in the 4% AEP (25 year) design event
Habitable Room	A room used as living accommodation within a dwelling but excludes bathrooms, toilets, halls, landings or rooms that are only capable of being used for storage. All other rooms, such as kitchens, living rooms, bedrooms, utility rooms and studies are counted.
Zone 3a High Probability	PPS25 Flood Zone, defined as areas at risk of flooding in the 1% AEP (100 year) design event
Informal Flood Defence	A structure that provides a flood defence function but has not been built and/or maintained for this purpose (e.g. boundary wall)
Local Development Framework (LDF)	Consists of a number of documents which together form the spatial strategy for development and the use of land
Zone 1 Low Probability	PPS25 Flood Zone, defined as areas less likely to flood than those in Zone 2 Medium Probability
Zone 2 Medium Probability	PPS25 Flood Zone, defined as areas at risk of flooding in events that are greater than the 1% AEP (100 year), and less than the 0.1% AEP (1000 year) design event
Planning Policy Guidance (PPG)	A series of notes issued by the Government, setting out policy guidance on different aspects of planning. They will be replaced by Planning Policy Statements.

Planning Policy Statement (PPS)	A series of statements issues by the Government, setting out policy guidance on different aspects of planning. They will replace Planning Policy Guidance Notes
PPG25	Planning Policy Guidance 25: Development and Flood Risk Office of the Deputy Prime Minister (ODPM), 2001
PPS25	Planning Policy Statement 25: Development and Flood Risk Department of Community & Local Government, December 2006
Previously Developed (Brownfield) Land	Land which is or was occupied by a building (excluding those used for agriculture and forestry). It also includes land within the curtilage of the building, for example a house and its garden would be considered to be previously developed land.
Residual Risk	A measure of the outstanding flood risks and uncertainties that have not been explicitly quantified and/or accounted for as part of the review process
SEA	Strategic Environmental Assessment
SUDS	Sustainable Urban Drainage System
Supplementary Planning Document (SPD)	Provides supplementary guidance to policies and proposals contained within Development Plan Documents. They do not form part of the development plan, nor are they subject to independent examination.
Sustainability Appraisal (SA)	Appraisal of plans, strategies and proposals to test them against broad sustainability objectives.
Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (The World Commission on Environment and Development, 1987).