WYRE BOROUGH COUNCIL

STRATEGIC FLOOD RISK ASSESSMENT

July 2016

CONTENTS

ABBREVIATIONS

Abbreviation	Definition
AAP	Area Action Plan
AMP	Asset Management Plan
AONB	Area of Outstanding Natural Beauty
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
FWMA	Flood and Water Management Act (2010)
IDB	Internal Drainage Board
LCC	Lancashire County Council
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NFCDD	National Flood and Coastal Defence Database
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
SAB	SuDS Approval Body
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
SuDS	Sustainable Drainage Systems

1.0 INTRODUCTION

1.1 Wyre Borough Council is in the process of producing a new Local Plan. This plan will set out the vision and planning and development strategy for the borough to 2031 and will comprise of a series of policies, site allocations and land designations. The Local Plan will be adopted in 2017. Once adopted, it will form the statutory Development Plan for Wyre and will replace the "saved" policies in the Local Plan 1999 and the Fleetwood-Thornton Area Action Plan (AAP).

1.2 Previously, the intention was to prepare a two-part Local Plan. This was to comprise of a Part 1 document (originally called the Core Strategy) setting out the strategic direction for the Local Plan, which was to be followed by a Part 2 document (originally called the Allocations Plan) that would identify the sites to help deliver the agreed strategy. As a consequence of the publication of the National Planning Policy Framework (NPPF) in March 2012 and the National Planning Policy Guidance (NPPG) in March 2014, and the updating of key evidence base documents, the Council has decided to prepare a single Local Plan (rather than two separate planning documents). This single Local Plan will both set out the strategic direction for the Borough and identify sites to deliver this strategy.

What is a Strategic Flood Risk Assessment?

1.3 Although flooding is a natural process that cannot be wholly prevented, good planning and management of the risk and consequence of flooding can help avoid and reduce the threat posed to people and property.

1.4 All forms of flooding and their impact on the natural and built environment are material planning considerations. Local planning authorities (LPAs) are therefore required to take flood risk into account at all stages of the planning process in order to avoid inappropriate development in areas at risk of flooding. Where new development is exceptionally necessary in such areas, appropriate action and mitigation should be taken to make it safe without increasing the risk elsewhere and, where possible, reducing overall risk.

1.5 A Strategic Flood Risk Assessment (SFRA) is a study carried out by one or more LPAs to assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and to assess the impact that land use changes and development in the area will have on flood risk.

1.6 The NPPF states that Local Plans should be supported by a SFRA and their findings should be used to inform strategic land use planning. The NPPG advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

- **Level 1 –** which is carried out in local authority areas where flooding is not a major issue and where development pressures are low.
- **Level 2 –** which is carried out where a Level 1 Assessment shows that land outside of flood risk areas cannot appropriately accommodate all the necessary development.

Wyre Strategic Flood Risk Assessment

1.7 As part of the evidence base to inform the preparation of the Local Plan Part 1 document (Core Strategy), a SFRA was produced in 2007. This SFRA identified flood zones for the Borough, established potential sources and pathways of flooding, considered the likely effects of climate change on flood risk and examined future development proposals, residual flood risks and appropriate mitigation measures. The SFRA highlighted that flood risk is a significant issue for the borough and, in particular, identified that over fifty percent of the current housing stock lies within an area that is at a high probability of flooding from tidal or fluvial sources.

1.8 The threat of flooding and the minimisation of flood risk is therefore a key priority and the Council takes its responsibilities with respect to the maintenance and improvement of flood protection assets and the promoting sustainable development very seriously The SFRA will therefore form a key part of the evidence base for the new Wyre Local Plan, ensuring that future development takes full account of flood risk and sustainability at the outset.

1.9 To provide appropriate supporting evidence to inform the preparation of the Local Plan there is a recognised need for the previous SFRA to be replaced. In particular, the existing SFRA will require updating to take into account changes to policy, legislation and guidance. There have also been updates to some of the data sets used to inform the SFRA. In addition, as the single Local Plan will allocate sites for development, an updated SFRA is required to provide a more detailed analysis of the level of flood risk at potential site allocations identified through the local plan process.

1.10 Although the SFRA will consider the risk of flooding from all sources, the Flood Map for Planning prepared by the Environment Agency (EA) provides a key input for the study. This map defines the following Flood Zones which

refer to the probability of river and sea flooding, ignoring the presence of defences.

Figure 1-1: Flood Zones

Flood Zone	Definition
Zone 1 – Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding.
Zone 2 – Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a – High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Zone 3b – Functional Floodplain	Land where water has to flow or be stored in times of flood.

Purpose of the Strategic Flood Risk Assessment

1.11 The overarching purpose of the Wyre SFRA is to provide up-to-date information on flood risk. It will increase the understanding of the nature of flood risk, provide strategic flood risk guidance and help inform decisions made on the allocation of land in the emerging Local Plan and the preparation of policies for the management of flood risk. The SFRA will also ensure that flood risk is considered at the earliest stage of the planning process, provide greater clarity and certainty to developers regarding which sites are suitable for developments of different types and ensure that the direct and cumulative impacts of development on flood risk are acknowledged and appropriately mitigated.

1.12 The SFRA will therefore have a critical bearing on the consideration of sites for development. Crucially, it will enable the Council to demonstrate that the risk-based, sequential approach to the allocation of development has been implemented and assist with the application of the Sequential Test and Exceptions Tests, where necessary.

1.13 This Level 1 SFRA Report will consist of a will update the previous SFRA that was prepared in 2007 and assess sources of flood risk across the Borough.

1.14 A separate Level 2 document will supplement this report by providing detailed assessments of the suitability of potential development site allocations across the Borough in terms of flood risk. This part of the study will consider the detailed nature of the flood hazard, taking account of the presence of flood risk management measures such as flood defences; and provide clear guidance on appropriate risk management measures for adoption on potential sites within Flood Zones 2 and 3.

2.0 STUDY AREA

2.1 The Borough of Wyre is a coastal authority in the North West of Lancashire. It shares a common land boundary with the City of Lancaster to the north, with the Boroughs of Ribble Valley, Preston and Fylde to the east and south respectively, and with Blackpool Unitary Authority along the remainder of its western boundary. The Borough has a population of approximately 108,000 and covers an area in excess of 28,000 hectares which is characterised by a distinct geographical polarity, with the urban concentration situated in the west of the Borough, and a large expanse of rural area to the east.

2.2 In terms of flood risk, the Borough can be split into five distinct areas as shown in Figures 2-1 and 2-2 below:

2.3 The Upper Wyre area contains the Forest of Bowland, a designated Area of Outstanding Natural Beauty (AONB), together with a number of small villages. The Central Wyre Area is the start of the lowland plains, which is mainly agricultural with a few large centres of population based around the River Wyre. The Over Wyre Lower Estuary is again largely agricultural with population centres around the coastal frontage and at the main river Wyre crossing point at Shard Bridge Hambleton.

2.4 The core area is bound on the western and northern frontages by the Irish Sea and the eastern frontage is bounded by the tidal River Wyre. To the south lies the boundary with Blackpool. The area consists of the highly populated urban towns of Fleetwood, Thornton Cleveleys and Poulton-le-Fylde. Bands of green belt split the urban areas.

2.5 The core area is predominantly in flood zone 3a and is protected from tidal inundation by concrete coastal defences to the western and northern frontages and by earth embankments to the east. Inspections of the coastal defences are undertaken on a six monthly basis.

2.6 Land Drainage to the core area is provided by a number of small to medium sized watercourses, of which 37km have been defined as main rivers. Of these, 5.1km are culverted. Inspections of the main river watercourses are undertaken on a risk basis at a frequency of between six and sixty months. The majority of Wyre's systems are considered to be higher risk and, as a result, the inspections are undertaken at the six monthly frequency. The inspection details are entered onto the Asset Information Management System (AIMS).

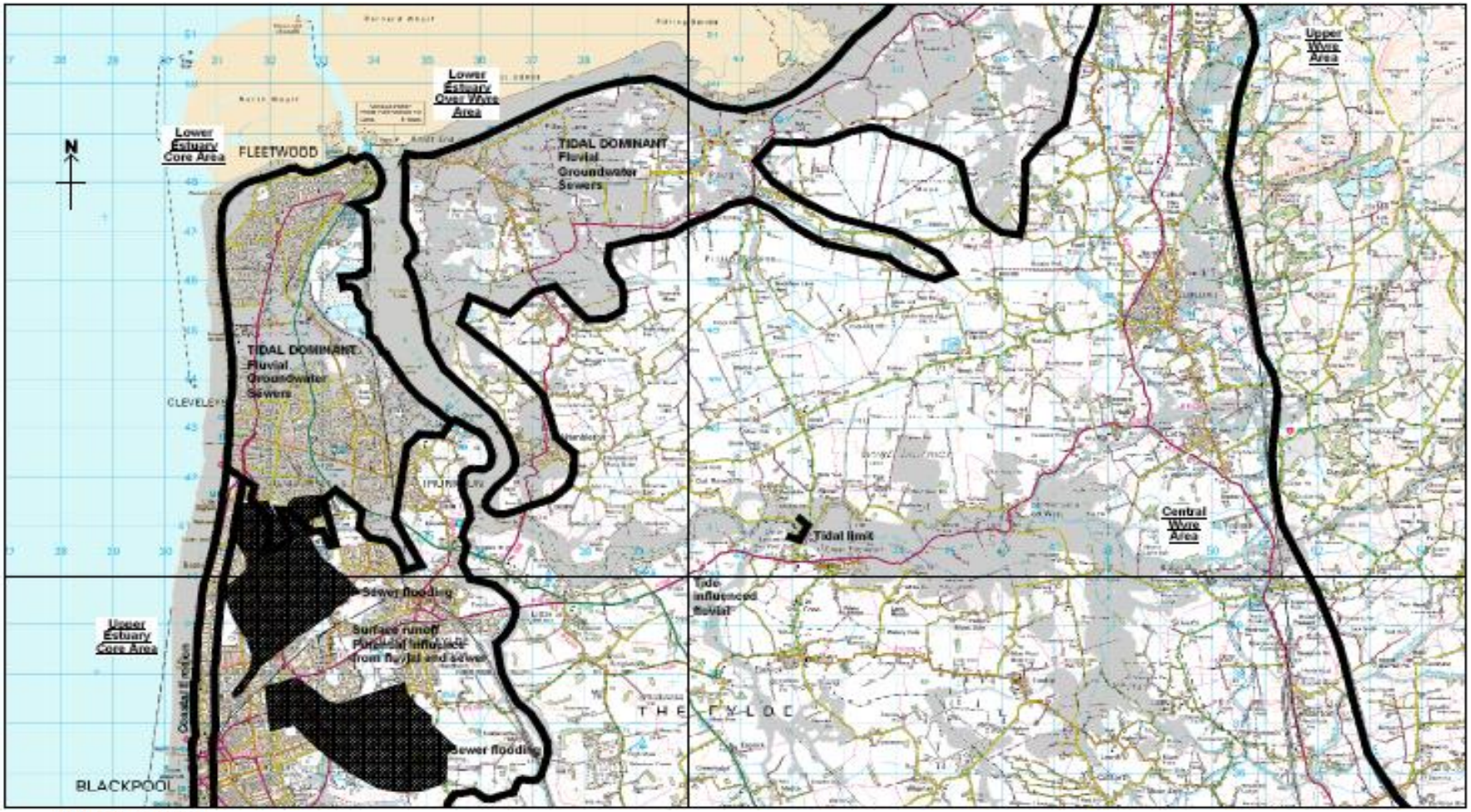
2.7 The areas and their main flood risks are described below:

Figure 2-1: Distinct Flood Risk areas in Wyre

Area	Area Description	Sources of Flooding
Upper Wyre	This area to the east of the M6 motorway is steeply sloped and contains relatively high land. The area contains a number of small villages but the majority is made up of agriculture and open green areas.	The main source of flooding is runoff from flash fluvial events. This is contributed to by agricultural practices and drainage of upper areas.
Central Wyre Area	The central area contains the larger villages of Garstang, St Michaels and Great Eccleston. The majority of the area lies above the 1 in 1000 year tidal level but is relatively flat with low hydraulic gradients. Apart from the villages mentioned above the majority of the area is medium quality agricultural land. The area contains two flood storage basins at Garstang and St Michaels.	The main source of flooding within this area is from fluvial sources. Because of the flat nature of the topography many of the secondary watercourses back up when the River Wyre is bank full during peak flow events. The flat topography also allows tidal influences to impact throughout much of the area and certainly further than the defined tidal limits at Cartford Bridge Little Eccleston. Limited flood risk exists from sewer systems and canals.
Core Area Upper Estuary	This area includes much of Blackpool and Poulton le Fylde and is largely urban in nature. The area lies above the 1 in 1000 year tidal level but is relatively flat with low hydraulic gradients. The west is fronted by the Irish Sea, which is protected from coastal erosion by concrete defences.	The main source of flooding within this area is surface run off although there are significant areas which are susceptible to sewer flooding notably the Gynn Square and Anchorsholme areas due to the high concentration of combined sewers and the low hydraulic gradients within these areas

Core Area Lower Estuary	This area is very low lying and flat with the majority of the area within flood zone 3a. The area is predominately urban in nature, with the exception of industrial areas to the east. The western and northern coastline is protected from erosion and flooding by concrete coastal defences. The majority of the eastern boundary is protected by earth embankments.	The main risk of flooding within the area is from tidal sources, from a breach of the coastal or estuary defences. This would lead to significant areas being flooded, including the majority of the existing development. The area is also susceptible to flooding from fluvial sources due to the low gradients and difficulty in discharging into the estuary, the various watercourses that drain the land. Similarly sewer flooding, groundwater and highway drainage systems can result in flooding problems as they are interconnected to the watercourses.
Over Wyre Lower Estuary	This area is very low lying and flat with the majority of the area in flood zone 3a. The area is predominately agricultural in nature with larger villages of Knott End, Pilling and Hambleton.	The main risk of flooding within the area is from tidal sources, from a breach of the coastal or estuary defences. This would lead to significant areas being flooded. The area is also susceptible to flooding from fluvial sources due to the low gradients and difficulty in discharging into Morecambe Bay. This is compounded by rising beach levels at the discharge points. Similarly sewer flooding, groundwater and highway drainage systems can result in flooding problems as they are interconnected to the watercourses and suffer from poor hydraulics and overcapacity in the urban areas.

Figure 2-2: Distinct Flood Risk areas in Wyre



3.0 POLICY CONTEXT

3.1 Since the 2007 Level 1 SFRA was completed, updates to national legislation and planning policy have been made. This section highlights the main changes that are of relevance to the SFRA.

Flood Risk Regulations (2009)

3.2 The Flood Risk Regulations transpose the EU Floods Directive (2007/60/EC) into UK Law. The regulations came into force on the 10th December 2009 and set out a number of duties for the EA and Lead Local Flood Authority (LLFA), which in the case of Wyre is Lancashire County Council (LCC).

3.3 As required under the Regulations, LCC have prepared a Lancashire Preliminary Flood Risk Assessment (PFRA). This involves identifying areas of "significant" local flood risk both from historic flood events and potential future flooding. For the purposes of the PFRA, the Department for the Environment and Rural Areas (Defra) defined "significant" future flood risk as risk affecting 30,000 or more people or 150 critical services (e.g. schools, hospitals, nursing homes, power and water services).

3.4 In terms of the Defra criteria, there are no significant flood risk areas in Lancashire. This means that there are no further actions required in the PFRA process before it is reviewed in 2017.

3.5 All the information collected for the PFRA will be used to inform the development of a Local Flood Risk Management Strategy as required under the Flood and Water Management Act 2010, which will consider the impact of flooding from heavy rainfall (including when the sewerage system is overwhelmed), an ordinary watercourse overflowing or its banks being breached, a dam overflowing or being breached, groundwater, or any combination of factors or sources.

Flood and Water Management Act (2010)

3.6 The Flood and Water Management Act (2010) (FWMA) arose as a response to the major floods that occurred across England in the summer of 2007 and broadly captured the recommendations set out in the Pitt Report which was commissioned after the floods to look at how flood risk was managed in England.

3.7 The FWMA introduces a number of new roles and responsibilities. LLFAs are encouraged to bring together relevant bodies and stakeholders to effectively manage local flood risk, which may include District/Borough Councils, Internal

Drainage Boards (IDBs), highways authorities, water companies and the EA. The new responsibilities that the Act assigns to LLFAs include:

- Coordinated management of flooding from surface water, ground water and ordinary watercourses;
- Development, maintenance and implementation of Flood Risk Management Strategies;
- Investigation and recording of local flood events; and
- Establishment and maintenance of a Flood Risk Asset Register
- Designation of flood risk structures and features which perform a flood risk management function;
- The responsibility for issuing Land Drainage Consents for work to ordinary watercourses;
- Contribution towards the achievement of sustainable development in exercising flood and water management duties.

3.8 The Act also makes the LLFA a statutory consultee in planning applications for all major development proposals which have surface water implications.

National Planning Policy Framework

3.9 The overarching aim of national planning policy on development and flood risk is to ensure that flood risk is taken into account at all stages of the planning process. In relation to plan-making this involves assessing flood risk, avoiding inappropriate development in areas at risk of flooding by directing development away from areas at highest risk and, where development is necessary in these areas, making it safe without increasing flood risk elsewhere.

3.10 The NPPF was issued in March 2012 to replace the previous Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs), including Planning Policy Statement 25 (PPS25) which set out previous national policy on planning and flood risk. Paragraph 100 of the NPPF specifically requires Local Plans to be supported by a SFRA and develop policies to manage flood risk from all sources, taking account of advice from the EA and other relevant flood risk management bodies, such as the Lead Local Flood Authority and Internal Drainage Boards.

3.11 The NPPF goes on to state that Local Plans should apply a sequential, risk-based approach to the location of development to avoid, where possible, flood risk to people and property and manage any residual risk, taking account of the impacts of climate change, by:

- applying the Sequential Test (see section 4);

- if necessary, applying the Exception Test (see section 4);
- safeguarding land from development that is required for current and future flood management;
- using opportunities offered by new development to reduce the causes and impacts of flooding; and
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of development, including housing, to more sustainable locations.

National Planning Practice Guidance

3.12 In March 2014 the NPPG was published to provide further guidance on how policy in the NPPF should be implemented. The NPPG explains that SFRAs should assess the risk to an area from flooding from all sources, now and in the future, taking account of the impacts of climate change, and should assess the impact that land use changes and development in the area will have on flood risk. The guidance goes on to state that SFRAs need to provide sufficient detail on all types of flood risk to enable the LPA to:

- determine the variations in risk from all sources of flooding across their areas, and also the risks to and from surrounding areas in the same flood catchment;
- inform the sustainability appraisal of the Local Plan, so that flood risk is fully taken into account when considering allocation options and in the preparation of plan policies;
- identify the requirements for site-specific flood risk assessments in particular locations, including those at risk from sources other than river and sea flooding;
- determine the acceptability of flood risk in relation to emergency planning capability; and
- consider opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance and storage for flood water.

3.13 The NPPG advocates a tiered approach to risk assessment and identifies the following two levels of SFRA:

- **Level 1** – which is carried out in local authority areas where flooding is not a major issue and where development pressures are low. The Assessment should be sufficiently detailed to allow the application of the Sequential Test to the location of development and to identify whether development can be allocated outside high and medium flood risk areas,

based on all sources of flooding, without application of the Exception Test.

- **Level 2** – which is carried out where a Level 1 Assessment shows that land outside of flood risk areas cannot appropriately accommodate all the necessary development and it is therefore necessary to increase the scope of the Assessment to a Level 2 to provide information necessary for the application of the Exception Test.

4.0 SEQUENTIAL AND EXCEPTION TESTS

4.1 The NPPF advocates a risk based approach to management of flood risk which is focussed on locating development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change. This approach comprises of the following steps:

Figure 4-1: Sequential Approach to Flood Risk Management

Step	Flood Risk Management Measure / Action	Description
1	Avoidance / Prevention	Allocate developments to areas of least flood risk and apportion development types vulnerable to the impact of flooding to areas of least risk
2	Substitution	Substitute less vulnerable development types for those incompatible with the degree of flood risk
3	Control and Mitigation	Implement measures to reduce flood frequency to existing developments. Appropriate design of new developments. Implement measures to mitigate residual risks.

4.2 This is known as the risk based sequential approach and should be considered throughout the planning process to ensure that opportunities are taken to minimise flood risk at every stage. The main aim of this approach is to ensure that risks to people, property and the environment are reduced to acceptable levels. The risk based sequential approach is delivered using the Sequential and Exception Tests.

Sequential Test

4.3 The Sequential Test is, in effect, a sieving process designed to steer new development to areas with the lowest probability of flooding, where possible. If flood risk avoidance was the sole consideration in the selection of development sites, this would mean that when a LPA is allocating sites for development in their Local Plan all sites that are in Flood Zone 1 (areas with a low probability of river or sea flooding) would be allocated before those in Flood Zone 2 (areas with a medium probability of river or sea flooding). Only

where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of the land use proposed.

4.4 The NPPF requires LPAs to apply this Sequential Test when allocating land for development in order to demonstrate that no reasonably available sites are available which have a lower probability of flooding that would be appropriate for the development. It advises that the SFRA should the basis for applying this test. It is also advised that within each flood zone, surface water and other sources of flooding need to be taken into account in applying the sequential approach to the location of development.

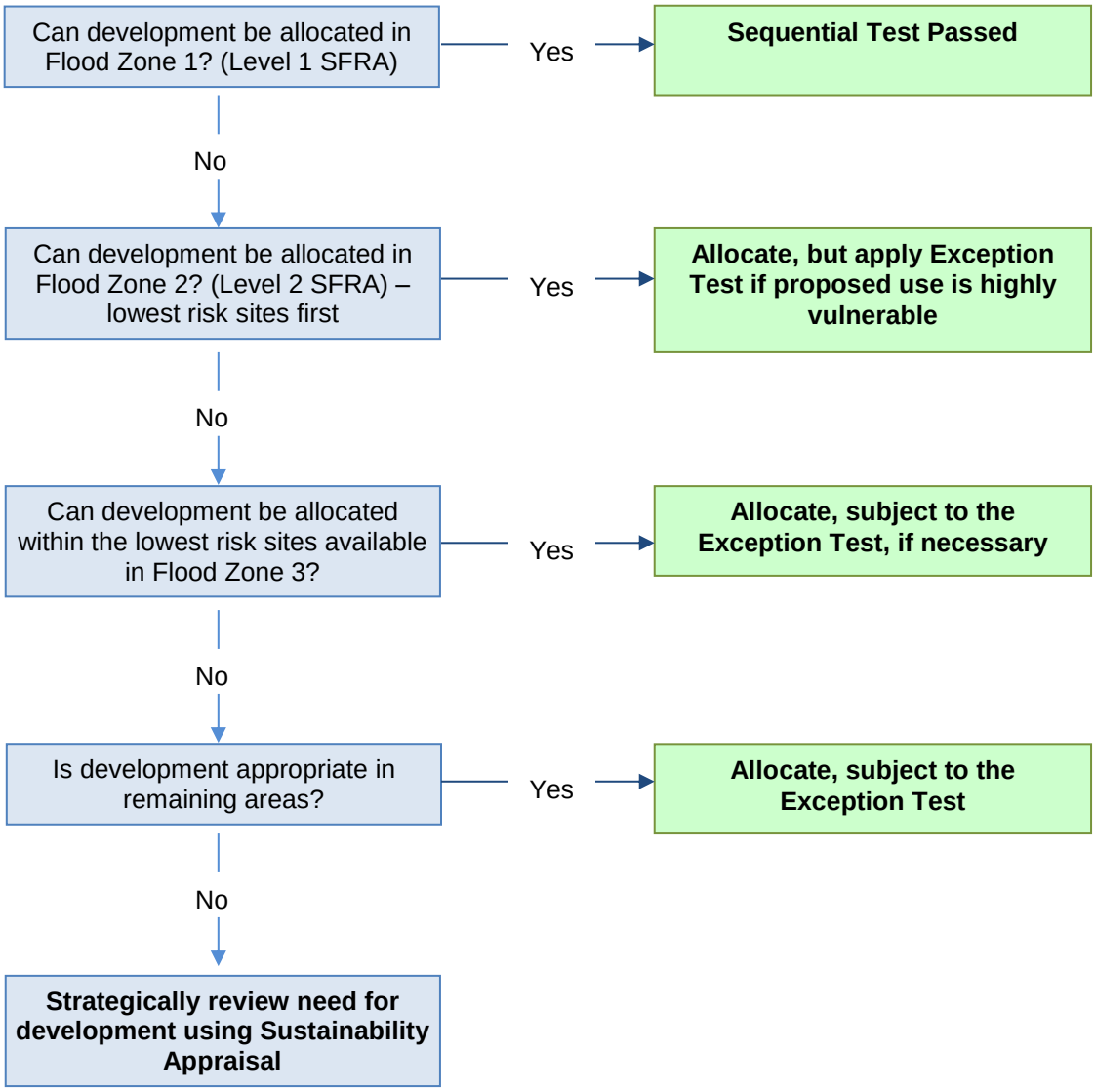
4.5 Where it is necessary, following application of the Sequential Test, to locate new development in Flood Zones 2 and 3a, such development should be focused within areas where:

- The preferred policy option in the relevant Catchment Flood Management Plan or Shoreline Management Plan is to 'hold the line';
- The standard of protection afforded by the existing defences is compatible with the land use type proposed;
- The application of the sequential approach has been used to identify the areas within the zone that are at least risk; and
- Flood forecasting and warning systems, as well as flooding emergency response procedures, are well-developed'.

4.6 If, following the application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding; the Exception Test can be applied if appropriate.

4.7 The application of the Sequential Test in the Local Plan preparation process is presented in Figure 4-2 below:

Figure 4-2: Application of the Sequential Test for Local Plan Preparation



Exception Test

4.8 Having completed the Sequential Test, the Exception Test aims to provide a method of managing flood risk whilst still allowing necessary development to occur in the interests of sustainable development.

4.9 Paragraph 102 of the NPPF allows the application of the Exception Test by a LPA where following application of the Sequential Test it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower risk of flooding. The Exception Test therefore provides a method of managing flood risk while still allowing for development to occur.

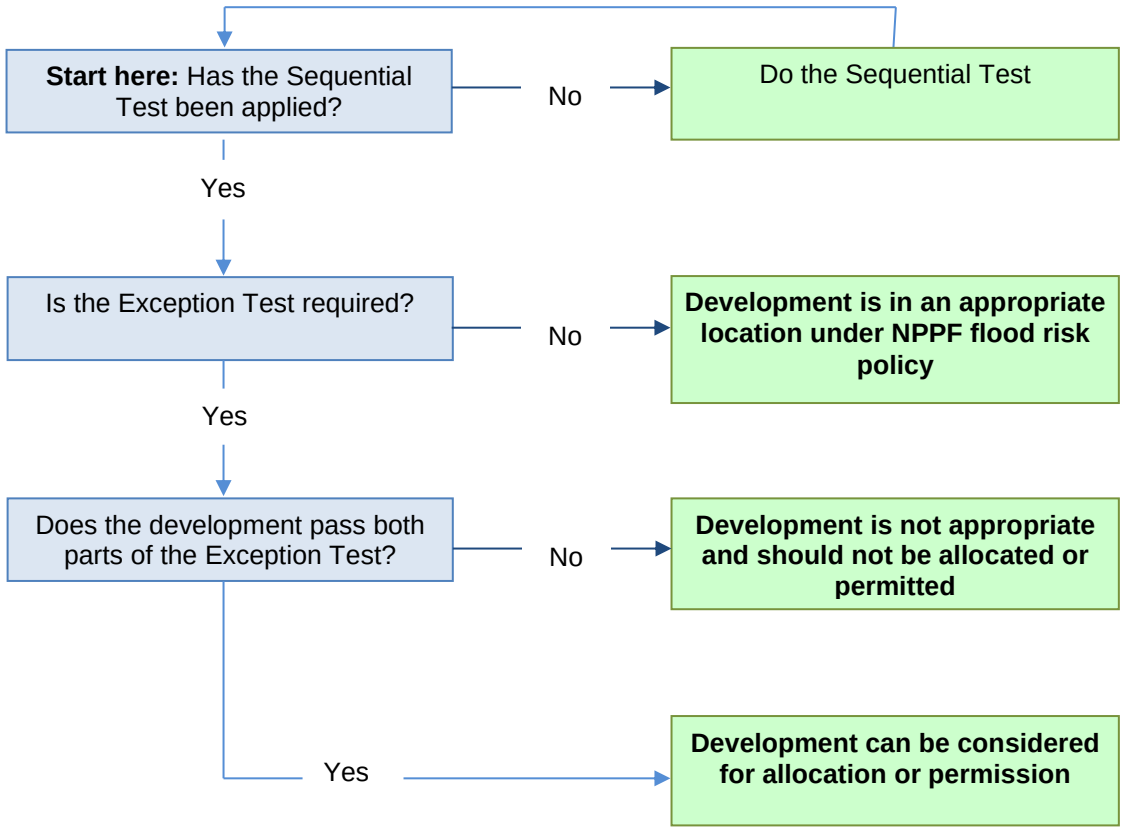
4.10 For the Exception Test to be passed:

- 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; and
- A site-specific Flood Risk Assessment (FRA) must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible will reduce flood risk overall.

4.11 Both parts of this test must be satisfied in order for the development to be considered acceptable in terms of flood risk. There must be robust evidence in support of every part of the test.

4.12 The process for applying the Exception Test in development management or when preparing a Local Plan is set out in Figure 4-2 below:

Figure 4-3: Application of the Exception Test



4.13 The application of the Exception Test must have regard to the vulnerability of the development proposed. The NPPG sets out flood risk vulnerability classifications for various land uses. This classification acknowledges that not all land uses have the same vulnerability to flooding and that some uses, such as residential developments, are more vulnerable to the potential loss of life and damage to personal property and possessions than retail or office developments for example.

4.14 Figure 4-4 below draws upon the guidance in the NPPG to illustrate the various flood risk vulnerability classifications, the flood zones that these uses are appropriate within and the instances in which the Exception Test will need to be applied.

4.15 By way of example, the table shows that within Flood Zone 1 all land uses are acceptable as flood risk is not considered to be a significant constraint to development. However, a site-specific FRA will be required on sites that are greater than one hectare in size and this assessment will need to consider other potential sources of flood risk, such as ground and surface water flooding. In Flood Zone 3a, potentially suitable land uses are water compatible (such as amenity open space, marinas and sewage transmission infrastructure) and less vulnerable uses (such as employment uses). More vulnerable uses (such as housing) and essential infrastructure uses should only be permitted in this zone if the Exception Test is passed. Highly vulnerable development should not be permitted in this zone.

Figure 4-4: Flood Risk Vulnerability Classification

Flood Risk Vulnerability and Flood Zone Compatibility	Essential Infrastructure e.g. transport and utility infrastructure	Water Compatible e.g. open space, docks, marinas and wharves	Highly Vulnerable e.g. mobile homes and police, ambulance and fire stations	More Vulnerable e.g. hospitals, residential institutions and dwellings	Less Vulnerable e.g. offices, industry and storage or distribution
Flood Risk Zone 1 – low probability	Yes	Yes	Yes	Yes	Yes
Flood Risk Zone 2 – medium probability	Yes	Yes	Exception Test Required	Yes	Yes
Flood Risk Zone 3a – high probability	Exception Test Required	Yes	No	Exception Test Required	Yes
Flood Risk Zone 3b – Functional Flood Plain	Exception Test Required	Yes	No	No	No

5.0 OVERVIEW OF KEY ROLES AND RESPONSIBILITIES

5.1 Responsibility for the management of flood risk falls within the remit of a number of bodies as set out in FWMA. The roles of the key parties are briefly outlined below.

5.2 Landowners and developers have the primary responsibility for managing the flood risk issues associated with their land. They are also responsible for managing the drainage of their land such that they do not adversely impact upon adjoining properties. The owners of assets such as canals and reservoirs are similarly responsible for managing the flood risk issues associated with them.

5.3 Wyre Council, as the LPA, has responsibility for completing a SFRA for the Borough and is responsible for following a sequential approach to decision making in relation to identifying sites for development; this means avoiding risk, substituting lower risk land uses and as a last resort controlling and mitigating risk. Working with assistance and advice from the EA, the Council is also responsible for flood risk in relation to new development proposals and also has a key emergency planning role which involves contingency planning for flood events.

5.4 LCC, as the LLFA, has a strategic role in overseeing the management of flood risk derived from surface water run-off, groundwater and ordinary watercourses which do not form part of a main river. Through the provisions of the Flood and Water Management Act, LCC has powers to do works to manage flood risk from surface water or groundwater and designate structures and features that affect flooding. The Act also gives LCC a wide range of responsibilities, including:

- Preparing and implementing a strategy for local flood risk management;
- Establishing and maintaining a register of flood risk assets;
- Recording and investigating of local flood incidents;
- Prepare and publish a PFRA; and
- The approval, or otherwise, of works to ordinary watercourses through the issuing of Land Drainage Consent.

5.5 'The Town and Country Planning (Development Management Procedure) (England) Order 2015 also introduced changes to the planning process making the LLFA a statutory consultee for all major development proposals with surface water implications.

5.6 LCC is also the relevant highways authority for Wyre and, as a result, is also responsible for providing and managing highway drainage and roadside

ditches wherever these are not privately owned, and must ensure that road projects do not increase flood risk.

5.7 United Utilities is the relevant sewage undertaker for Wyre. They are responsible for water supply and for any public sewers adopted under the requirements of the Water Industry Act 1991. United Utilities are required to investigate flooding from sewers and carry out improvements and/ or maintenance where appropriate and affordable, in accordance with guidance from Ofwat (The Water Services Regulation Authority). This is undertaken through the preparation of Asset Management Plans (AMPs), approved by Ofwat, which include investment programmes to manage the flood risk from sewers.

5.8 The EA has a statutory responsibility for flood management and defence to existing properties, communities and assets in England and has a strategic overview of all forms of flooding. It is responsible for delivering sustainable flood management solutions and for preparing strategic plans for measures to reduce flood risk. They are the competent authority for the Water Framework Directive, produce Catchment Flood Management Plans (CFMPs) and Shoreline Management Plans (SMPs), produce Flood Risk and Hazard Maps, and aim to assess how land management practices can deliver flood risk management benefits.

6.0 RELEVANT STUDIES

6.1 A number of studies and plans relating to flood risk have been prepared for the area covered by this SFRA. The hierarchy of these studies and plans is shown in Figure 6-1 below and their conclusions of relevance to this assessment are tabulated in Figure 6-2.

Figure 6-1: Hierarchy of Relevant Flood Risk Studies

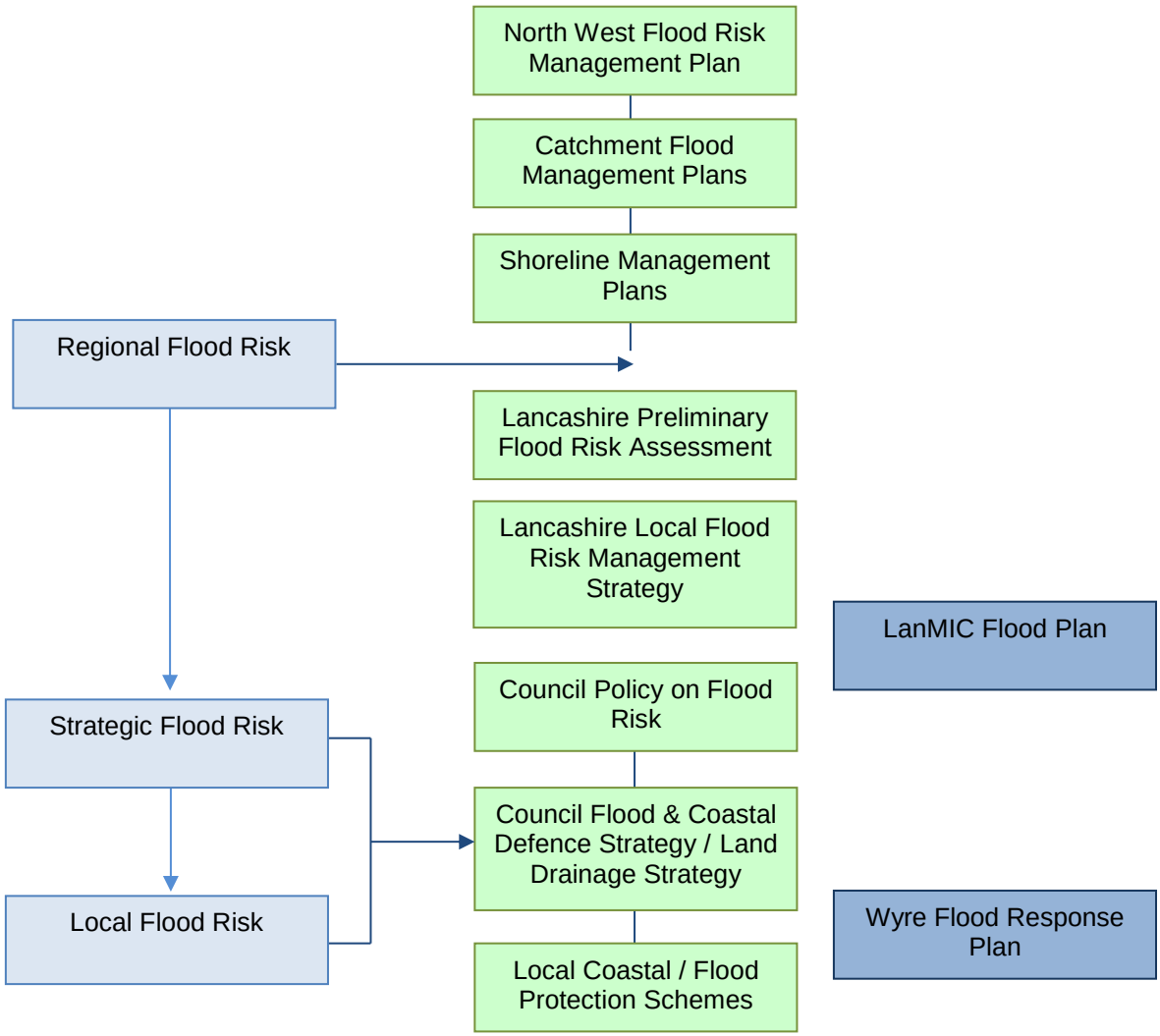


Figure 6-2: Relevant Studies

Study / Plan	Brief Description of Contents	Key Conclusions
Draft North West Flood Risk Management Plan (FRMP) (2014)	The draft North West FRMP identifies the hazards and risks from rivers, the sea, surface water, groundwater and reservoirs and set out how Risk Management Authorities will work together with communities to manage flood risk. The FRMP sets out where and how to manage flood risk to provide most benefit to communities and the environment. It seeks to: • Help develop and promote a better understanding of flood and coastal erosion risk; • Provide information about the economic and environmental benefits to inform decision makers; and • Identify communities with the highest risk of flooding so that investment can be targeted at those in most need.	Urban areas within the Wyre catchment are generally located within the main fluvial and tidal flood plain areas. Future development in this area should be undertaken in a sustainable manner in order to alleviate added flood risk. The whole length of the Wyre catchment frontage is protected by tidal defences; the main areas that could be affected by defence overtopping are central and north Blackpool, Cleveleys, Rossall and parts of Knott End. Tidal flooding also affects communities within the Wyre Estuary such as Thornton and Hambleton. Over a quarter of the residents in the Wyre catchment are at some risk of either fluvial or tidal flooding. Approximately 4.5% of the total population within the catchment are at risk of flooding from reservoirs.
River Wyre CFMP (2009)	The Wyre CFMP is one of 77 CFMPs prepared by the EA to assess inland flood risk from rivers, groundwater, surface water and tidal flooding, but not flooding directly from the sea (coastal flooding).	River flooding from the River Wyre has historically been an issue of concern, especially within the areas of Garstang, St. Michaels-on-Wyre and Great Eccleston, and tidal flood risk is a key issue for the downstream reaches of the River Wyre and the tributaries entering the Wyre in the lower catchment.

Study / Plan	Brief Description of Contents	Key Conclusions
	The role of CFMPs is to help us to understand the scale and extent of flooding now and in the future and identifies policies which will deliver sustainable flood risk management within the catchment for the long term. The CFMP identifies the size and location of various influences that can make a contribution towards and affect the consequence of flooding.	Groundwater flooding is not thought to be a significant issue but sewer flooding has been recorded in the urban areas stretching from Blackpool northwards to Fleetwood, and in the middle of the catchment between St Michaels and Garstang. Approximately 7,600 properties in the catchment have a 1% chance of flooding in any one year from rivers – over 90% of which are in the towns of Fleetwood, Cleveleys, Poulton-le-Fylde and Thornton. The majority of the catchment has existing defences that protect property and agricultural land to a standard of protection between 2% and 3%. Flood risk management measures include: • Flood alleviation basins at Garstang and Catterall; • Raised defences along the River Wyre; and • Pumping stations at Yoad Pool and Raikes Brook. Climate change is likely to have the greatest impact on future flood risk, followed by land management change, and then urbanisation.

Study / Plan	Brief Description of Contents	Key Conclusions
North West England and North Wales SMP - Sub-cell 11b: Southport Pier to Rossall Point (2010)	The SMP provides a large-scale assessment of the risks associated with erosion and flooding at the coast. It presents policies to help manage these risks to people and to the developed, historic and natural environment. The SMP breaks the coastline down into five cells. Sub cell 11b relates to the coastline between Southport Pier and Rossall Point.	The long term plan for the Fylde Peninsula is to continue to provide protection through maintenance of formal defences in combination with encouraging the natural dune system to evolve where possible, as a natural form of defence. The frontage north of Anchorsholme is low lying and potentially at flood risk from both the open coast and the Wyre estuary. This frontage is heavily urbanised. Consequently, much of the shoreline is now held seaward of its natural position and this has implications for future management of this coastline as sea levels rise. The long term plan is to provide continued protection – the residential areas of Thornton and Cleveleys will therefore continue to be defended.

Study / Plan	Brief Description of Contents	Key Conclusions
North West England and North Wales SMP - Sub-cell 11c Rossall Point to Hodbarrow Point (2010)	The SMP provides a large-scale assessment of the risks associated with erosion and flooding at the coast. It presents policies to help manage these risks to people and to the developed, historic and natural environment. The SMP breaks the coastline down into five cells. Sub cell 11b relates to the coastline between Rossall Point and Hodbarrow Point.	The vast areas of flood risk at Fleetwood, Cleveleys and Knott End and development lying within those areas justify continuing to provide appropriate flood risk management measures in the long term. There are some areas in the upper reaches of the Wyre estuary where realignment opportunities back to higher land, would provide additional intertidal habitat that could offset future impacts of flood defences on the internationally important sites. Managed realignment is therefore recommended, but in a managed way which is conducive for potential habitat creation purposes.
Lancashire Area Preliminary Assessment Report (2011)	The report identifies areas of "significant" local flood risk both from historic flood events and potential future flooding. For the purposes of the PFRA, Defra have defined "significant" future flood risk as affecting 30,000 or more people or 150 critical services (e.g. schools, hospitals, nursing homes, power and water services).	There are no significant flood risk areas in Lancashire. This means that there are no further actions required in the PFRA process before it is reviewed in 2017.

Study / Plan	Brief Description of Contents	Key Conclusions
Lancashire and Blackpool Local Flood Risk Management Strategy (LFRMS) (2014)	Identifies how the County Council and Blackpool Council intend to manage the risk from local sources of flooding. Local sources of flooding, are those from ordinary watercourses (small streams and channels), pluvial (surface water runoff as a result of heavy rainfall) and groundwater (where water held beneath the ground reaches the surface). The LFRMS identifies roles and responsibilities for managing flood risk, describes local flood risks across Lancashire, states how local flood risks at specific locations will be managed, gives information on the management of assets that have a flood risk management function and explains locally important issues that will be addressed as part of the Local Strategy.	In the low lying areas to the west of the M6, the risk of flooding is predominately linked to the capacity of the drainage networks, including piped networks in urban areas and open drainage ditches in both urban and rural areas. Flooding in this area is frequently as a result of the interaction of a number of sources. In the lowest areas near the coast, sea level has a large influence on flooding. High tides and storm surges can increase water levels in channels and cause drainage systems to stop discharging to the sea. In order to reduce the level of risk, there are a number of pumping stations throughout the lowland areas, particularly near the coast, where pumping is needed to ensure that water will discharge when sea levels are high. New development in low-lying areas has to be carefully managed as many of the drainage ditches and pumping stations are operating at or near full capacity. The Lancaster Canal poses a potential flood risk and there are several reservoirs in the district which pose a medium risk of flooding.

Study / Plan	Brief Description of Contents	Key Conclusions
Wyre Council Policy for Flood Risk Management	The policy statement was produced by Wyre to explain the Council's approach to coastal and flood protection.	Commitment to improving, maintaining and monitoring defences.
Wyre Flood and Coastal Defence Strategy Plan (2011)	The original Wyre Flood and Coastal Defence Strategy Study was prepared in 2002 and has since been adopted by Wyre Borough Council. The original Strategy identified coastal defence strategies for the management of the Wyre coastline that were environmentally, technically and economically acceptable. The report was updated in 2011 to ensure that the strategy for the management of the coastal frontage is up to date with respect to European, National and Local policies and guidelines, and that the results of any studies, investigations and monitoring that have been undertaken since the original Strategy are used to increase the knowledge and understanding of this stretch of coastline.	A range of measures are proposed for managing flood risk in the towns of Thornton Cleveleys, Poulton and Fleetwood.

Study / Plan	Brief Description of Contents	Key Conclusions
Wyre Land Drainage Strategy Plan (2004)	This strategy plan concerns the Land Drainage system within the catchment area of the River Wyre and all towns in the Borough including villages of over 50 properties. It investigates all watercourses defined as critical and also considers discharges from surface water sewers and the interaction between main river and ordinary watercourses. The strategy aims to establish a long-term sustainable plan for the land drainage of the whole Borough to address current and future problems over a 50 year time scale.	Recommended strategies are prepared for each watercourse. Measures advocated include undertaking asset surveys on the condition of culverts, the creation or expansion of flood storage areas and the upgrading of pumping stations.
LanMIC Emergency Flood Response Plan	The Lancashire Major Incident Plan has been produced in response to the 2004 Civil Contingencies Act. A specific multi agency plan in response to flood risk has been prepared and is managed in partnership with the Blue Light services, the Environment Agency and Local Authorities. The Plan sets out the roles and responsibilities of organisations that respond to fluvial and tidal flooding within Lancashire with the intention to provide a co-ordinated, multi-agency response to flooding incidents.	Comprehensive emergency arrangements to respond to flood events are in place and are well practiced.

Study / Plan	Brief Description of Contents	Key Conclusions
Wyre Flood Response Plan	This plan sets out Wyre Council's arrangements, and identifies the responsibilities and the actions to be taken by the Council, in responding to a flood warning issued by the Environment Agency or to local conditions regardless whether a warning is issued. Although the plan does not cover flooding from foul sewers, burst water mains, private lakes or canals, should significant flooding occur from one of these sources, elements of the plan may be activated to support the multi-agency response.	Comprehensive emergency arrangements to respond to flood events are in place and are well practiced. These arrangements include both generic measures that would be applied on a Borough-wide basis and more detailed site-specific plans.
National Flood and Coastal Erosion Risk Management Strategy for England	This strategy provides the overarching framework for future action by all risk management authorities to tackle flooding and coastal erosion in England. It builds on existing approaches to flood and coastal risk management and promotes the use of a wide range of measures to manage risk. The strategy shows how communities can be more involved in local flood and coastal erosion risk management. It also emphasises the need to balance national and local activities and funding.	The strategy encourages more effective risk management by enabling people, communities, business, infrastructure operators and the public sector to work together to: • ensure a clear understanding of the risks of flooding and coastal erosion, nationally and locally, so that investment in risk management can be prioritised more effectively; • set out clear and consistent plans for risk management so that communities and businesses can make informed decisions about the management of the remaining risk; • manage flood and coastal erosion risks in an appropriate way, taking account of the needs of communities and the environment; • ensure that emergency plans and responses to flood incidents

Study / Plan	Brief Description of Contents	Key Conclusions
		are effective and that communities are able to respond effectively to flood forecasts, warnings and advice; • help communities to recover more quickly and effectively after incidents.

7.0 HISTORIC FLOODING

7.1 The previous SFRA published in 2007 included an assessment of historic flooding in the borough. This highlighted that Wyre has a long history of flood events which have affected various parts of the Borough. The first recorded event was the destruction of Singleton Thorpe in 1555. The River Wyre catchment in particular has a long history of flooding but recently there have been two major events. In November 1977, a severe storm coincided with a spring tide, resulting in flooding in Thornton-Cleveleys and Knott End-on-sea. In 1980 a breach to one of the flood embankments resulted in flooding in the village of St Michaels, costing millions of pounds.

7.2 Since the publication of the 2007 SFRA there has been a coastal flooding event in 2013/14. An updated list of historical flooding events is provided below.

Figure 7-1: Historical Flood Events in Wyre

Year	Season	Comments / Quotation	Watercourse / Area
2013/14	Winter	Severe storm conditions in December 2013 and January 2014 led to significant damage to the beach management timber groyne structures in Cleveleys and Fleetwood, resulting in losses to the barrier beaches along the Wyre coastal frontage. The Winter event of 2013 was of similar conditions to those observed in 1977.	Sea
2012	Summer	Heavy persistent rain resulted in 80% of the average monthly rainfall falling on Monday 24th into Tuesday 25th September. 12 properties in Hambleton were flooded due to flow from the highway drainage and sewer networks, and 7 properties in Preesall suffered flooding as a result of excess discharges to a culvert. Extensive field flooding also reported.	
2002	Winter	Tidal event on 1st February 2002. Predicted tide 4.9m at 13.42 hrs, wind force gale 8. No flooding to properties but road on St. Bernard's Road (sandbagging of properties by Wyre BC), affected and promenade.	Sea
		Ramper Pot Key – no properties actually flooded, but were surrounded – breach in bank.	
		Tidal event on 1st February 2002, Hambleton area. Kiln Lane flooded, flooding directly from Wardleys Pool.	
2000	Winter	2 properties reported flooded. Extensive	Ainspool

Year	Season	Comments / Quotation	Watercourse / Area
		flooding to frontages of Ainspool Lane in the village. Ainspool running full & water level higher than the A586 so suspect that surface water drainage prevented from working.	
		Almond's Farm flooded for several days. Water overtopped primary defence of flood basin in November 2000. The farm has a secondary defence for its individual protection. Water overtopped this also.	Whites Brook
		Myerscough Microlight Centre – extensive flooding to the hangers & offices of the centre. 8 caravans and 2 tractors underwater in November 2000. Flooding believed to be due to overtopping of Withney Dyke	Withney Brook
1998	Winter	Large tree bow (0.4m dia x 5m length) jammed in tidal door. A road gully discharging into Main Dyke was also without a flap as the casting had corroded. Gardens, road and garage flooded.	Main Dyke
1995	Winter	Important rainfall event: during this period the flood alleviation basins (Garstang and Catterall) operated near to full capacity and no property at risk has been reported.	Wyre
1983	Winter	In October 1980 and again in December 1983, heavy rainfall caused widespread flooding in the Wyre catchment.	Wyre
1982		Catterall and Garstang flood basins were constructed.	Wyre
1980	Winter	Swollen river and high tide push the water level to worrying heights at Shard Bridge. The village of St. Michaels on Wyre was cut off from the world in November 1980 when the Wyre twice broke its banks. The fold cost millions of pounds.	Wyre
		In October 1980 heavy rainfall caused widespread flooding in the Wyre catchment. At Abbeystead 223mm fell within a six day period. Flooding resulted primarily from a fallen tree, which breached the flood embankment. Altogether 2000ha of land and over 400 houses were affected.	
		Flooded areas of St. Michaels, Garstang and Great Eccleston.	
1977	Winter	Storm on 11th/12th November 1977. Flooding at	Wyre

Year	Season	Comments / Quotation	Watercourse / Area
		Fleetwood West Shore and Cleveleys Frontage, estimated as 1:100 event in report by Lewis and Duvivier 'Borough of Wyre – Extension of Sea Defences – First Report – March 1978'.	
1959	Winter	There was a 'remarkable' fall at Garstang [Scorton], north Lancashire, when approximately 50mm of rain was recorded in 60 minutes.	Wyre
1958	Winter	Some of the worst flooding occurred in the Blackpool. One of the most seriously affected areas was the Mere Road district of Blackpool; flood water was waist deep soon after the commencement of the hour-long storm.	Wyre
1914	Winter	Abbeystead Reservoir, River Wyre: "The particulars that have been supplied by the Water Engineer show that the highest water level attained in the reservoir has been 1.05m above the overflow sill. This was during the flood of 9th January 1914, when 65mm of rain was recorded in 24 hours at the Abbeystead Reservoir gauge".	Wyre
1891	Summer	1891 August rainfall observer at Garstang (Calder Mount). Rain 245mm; the previous wettest month in 24 years being September 1872, when 242mm fell.	Wyre
1860		Abbeystead Reservoir was constructed and then further enlarged in 1881.	
1853	Winter	Around 1853 a serious flood overcharged the mill pond at Barton Corn Mill and the weir gave way.	Wyre
1787	Winter	On the 20th October there was a great flood when three bridges, Lee, Abbeystead and Stairs, were washed away and Dolphinholme and Street bridges were greatly damaged.	Wyre
1787	Summer	On the 10th August Damas Ghyll overflowed much land and washed a deal of hay away. The Wyre washed the company's Dolphinholme weir out and the factory weir fender mouth and thirty yards of earth and did a great deal of damage besides.	Wyre

8.0 TOPOGRAPHY, HYDROLOGY AND GEOLOGY AND SOILS

8.1 The Borough of Wyre encompasses an area in excess of 28,000 hectares. It is characterised by a distinct geographical polarity, with the urban concentration of Fleetwood, Thornton, Cleveleys and Poulton-le-Fylde situated in the west of the Borough, and a large expanse of rural area to the east.

Topography

8.2 As indicated in Figure 8-1, there is a clear dichotomy of topographic regions within Wyre. The area to the east of the M6 Motorway is steeply sloped and contains relatively high land with elevations in excess of 200m AOD.

8.3 The majority of the area to the west of the M6 Motorway is flat and very low lying with elevations typically below 40m AOD. Within the urban areas in the west of the Borough the flat topography of the area means that the land drainage system relies upon flood assist pumping stations in order to discharge flood water and surface water effectively from the urban area.

Hydrology

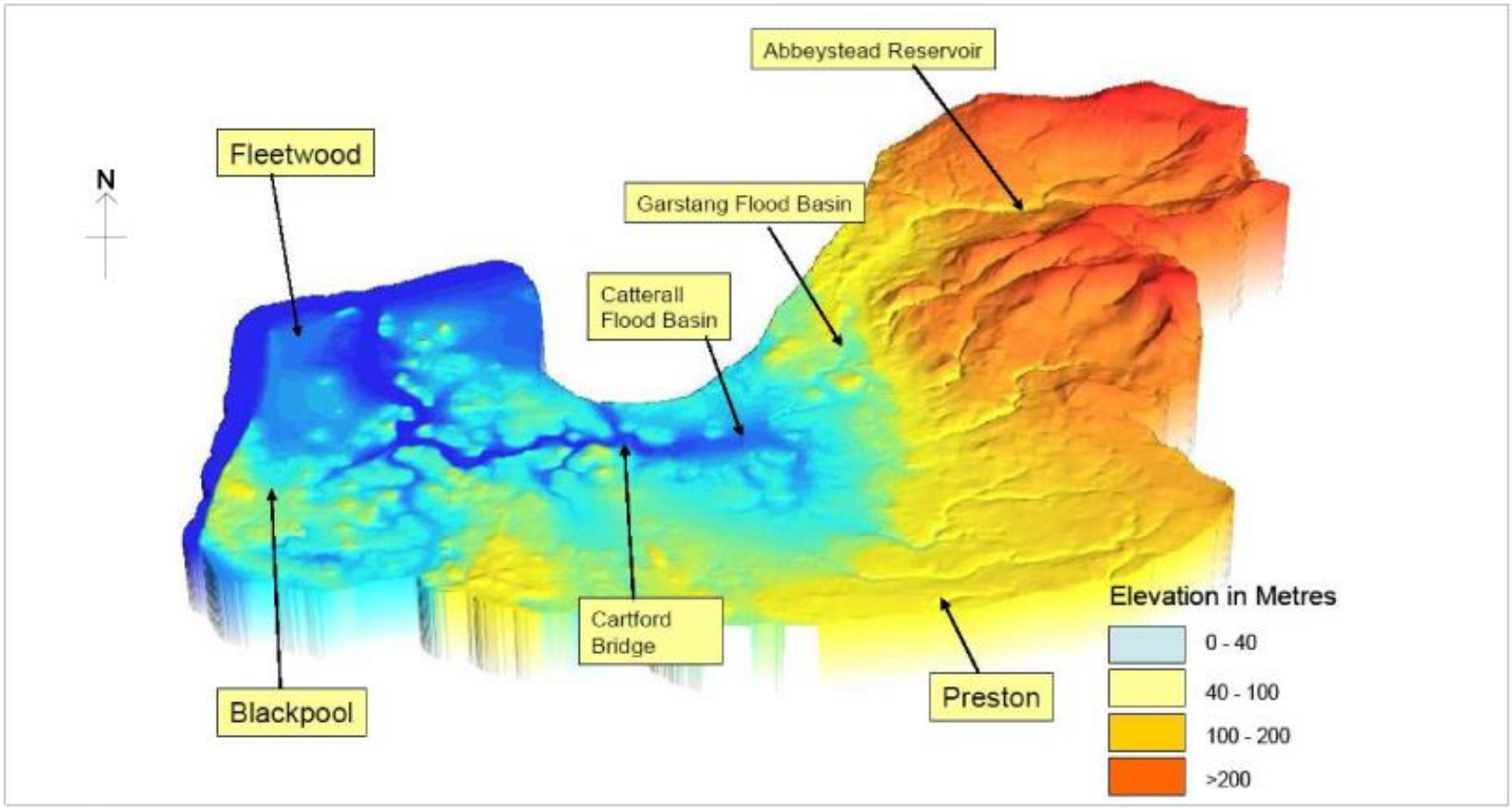
8.4 The principal watercourse flowing through the Borough is the River Wyre, with a number of smaller tributaries including the River Calder and the River Brock. The Lancaster Canal also runs through the Borough as well as a large number of smaller drains and watercourses.

8.5 There are a number of reservoirs in the Borough - including Grizedale, Barnacre and Grizedale Lea which provide storage for public water supply.

Geology and Soils

8.6 The geology of a catchment can be an important influencing factor on the way that a catchment responds to rainfall due to variations in permeability of the strata. The drift geology of River Wyre Catchment is shown in Figure 8-2.

Figure 8-1: Topography



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Wyre SFRA

Ordnance Survey Licensed System Supplier

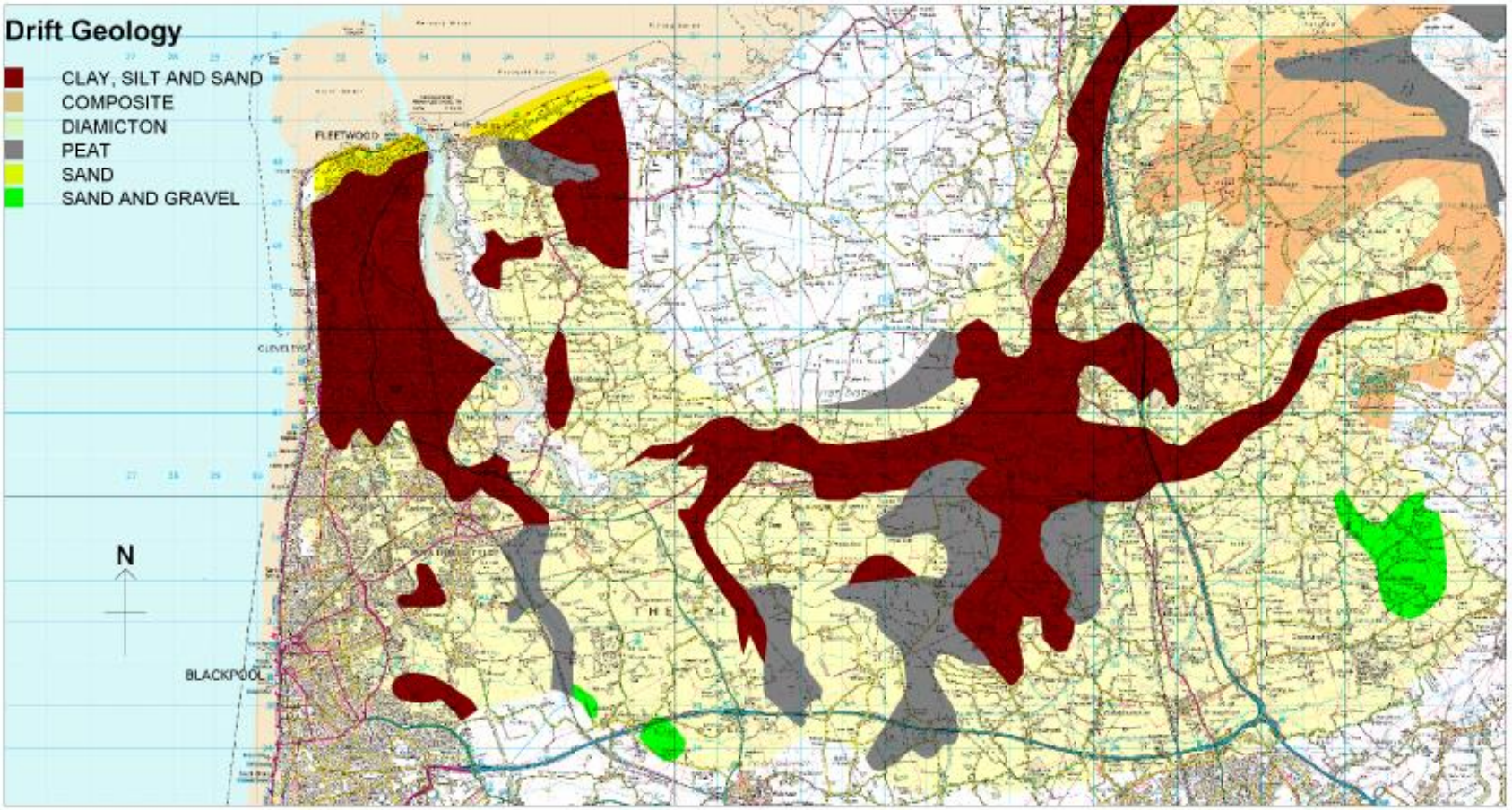
Title: Topography

Drawn: M.Wilkinson

Drawing No:

Date: 27.03.07 Scale: 1:160000

Figure 8-2: Drift Geology



9.0 EXISTING FLOOD RISK

River and Sea Flooding

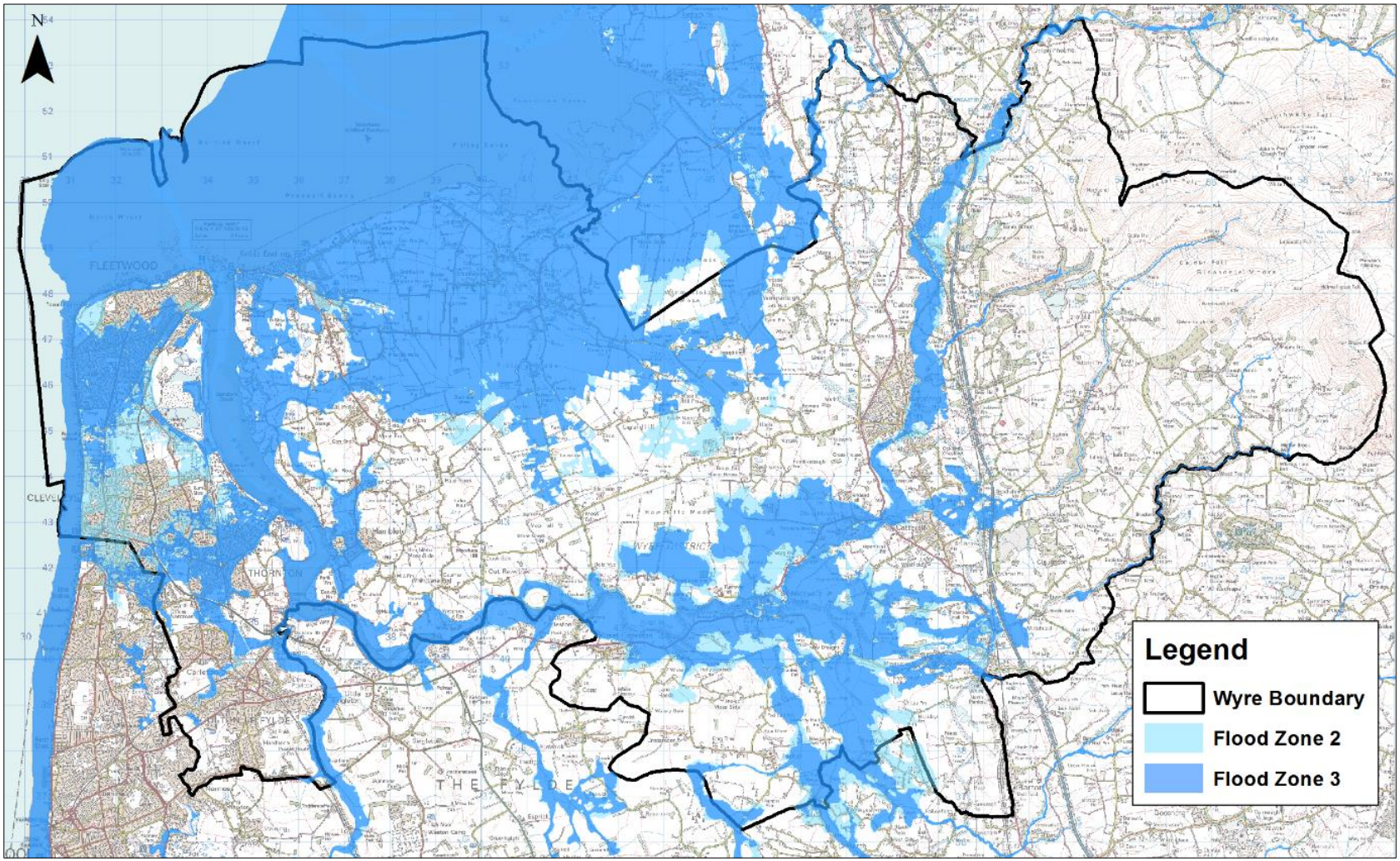
9.1 During heavy or prolonged rainfall events, rivers can encounter large flows which can result in them exceeding their capacity (fluvial flooding). Additionally, when a river has a tidal influence, high tides and storm surges can result in river capacity exceedance. Tidal flooding can also occur when an exceptionally high tide, almost always accompanied by a storm tide surge, overtops and/or breaches the tidal defences along a coastline.

9.2 The EA have produced the Flood Map for Planning (Rivers and Sea) which is a multi-layered map providing information on flooding from rivers and the sea in England and Wales. The EA's flood risk map for the study area is shown in Figure 9-1 below.

9.3 The flood zones shown on the map correspond to those defined in the NPPG as Zone 2 (Medium Probability) and Zone 3 (High Probability). This map delineates the probability of flooding from rivers and the sea in Wyre but it does not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. It also does not consider the presence of defences and does not consider other sources of flooding.

9.4 As indicated in Figure 9-1, a significant proportion of Wyre is considered to be at a medium or high risk of flooding from rivers or the sea. This is particularly prevalent in the western and coastal parts of the Borough but also effects areas to the north and east of Garstang and a significant proportion of the Central Wyre Area around Great Eccleston and St. Michaels.

Figure 9-1: Flood Map showing Flood Zone 2 and 3



Source: Environment Agency

Surface Water Flooding

9.5 Flooding from surface water runoff usually occurs when rainwater does not drain away through drainage systems or soak into the ground and instead lies on or flows over the ground. This form of flooding typically occurs following a period of prolonged rainfall when either the ground is saturated or sewers/drainage is at full capacity. It is inextricably linked to issues of poor drainage and sewer flooding. Surface water flooding can also occur when the intensity of the rainfall prevents rainwater from having time to flow into sewers or soak into the ground.

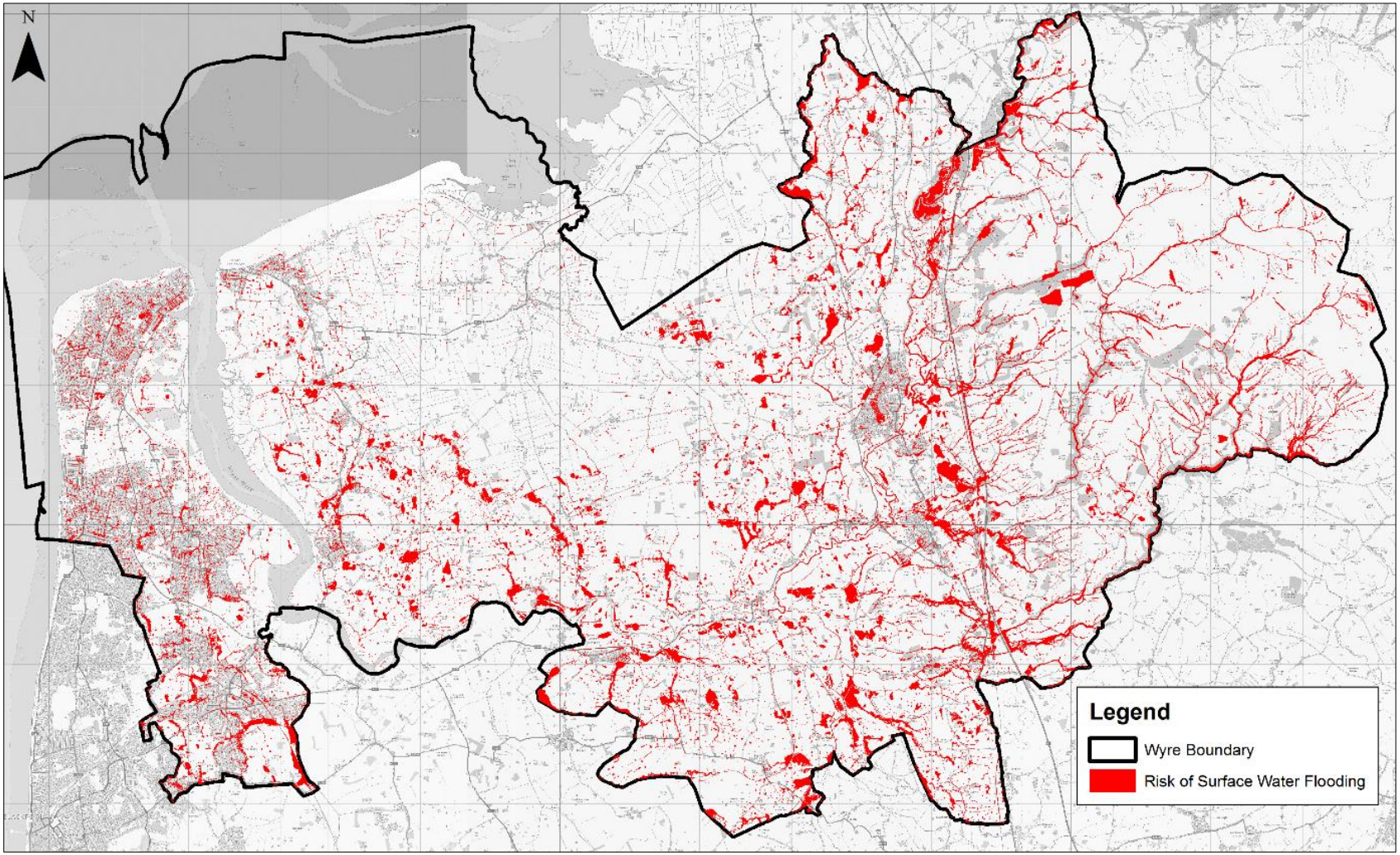
9.6 The numbers of properties at risk from surface water flooding in Wyre is in excess of 1,300. The EA have produced a map showing the risk of flooding from surface water. This map for the study area is shown in Figure 9-2 below.

9.7 Figure 9-2 highlights that significant areas of the Borough are at some risk of surface water flooding, although the level of risk within these areas does vary significantly. Eastern parts of the Borough, which are in relatively close proximity to the foothills of the Forest of Bowland, are shown to have a particular susceptibility to surface water flooding.

9.8 Parts of the Fylde Coast Peninsula also appear to have a significant susceptibility to surface water flooding which is likely to reflect the comparatively urban nature of this part of the Borough and the associated prevalence of impermeable surfaces which reduce the potential for land to attenuate surface water runoff. In addition, the flat topography, and the tidal nature of the water bodies around this area, mean that surface water drainage is reliant on pumping to discharge during periods of high tide (for drainage systems flowing into the sea) or high fluvial flow (for drainage systems flowing into a main river or ordinary watercourse). Given that pumping stations have limited capacity, they can be overwhelmed which increase the risk of surface water flooding during extreme rainfall events.

9.9 By comparison, large parts of Over Wyre Lower Estuary area have a relatively low susceptibility to surface water flooding.

Figure 9-2: Surface Water Flooding



Source: Environment Agency

Groundwater Flooding

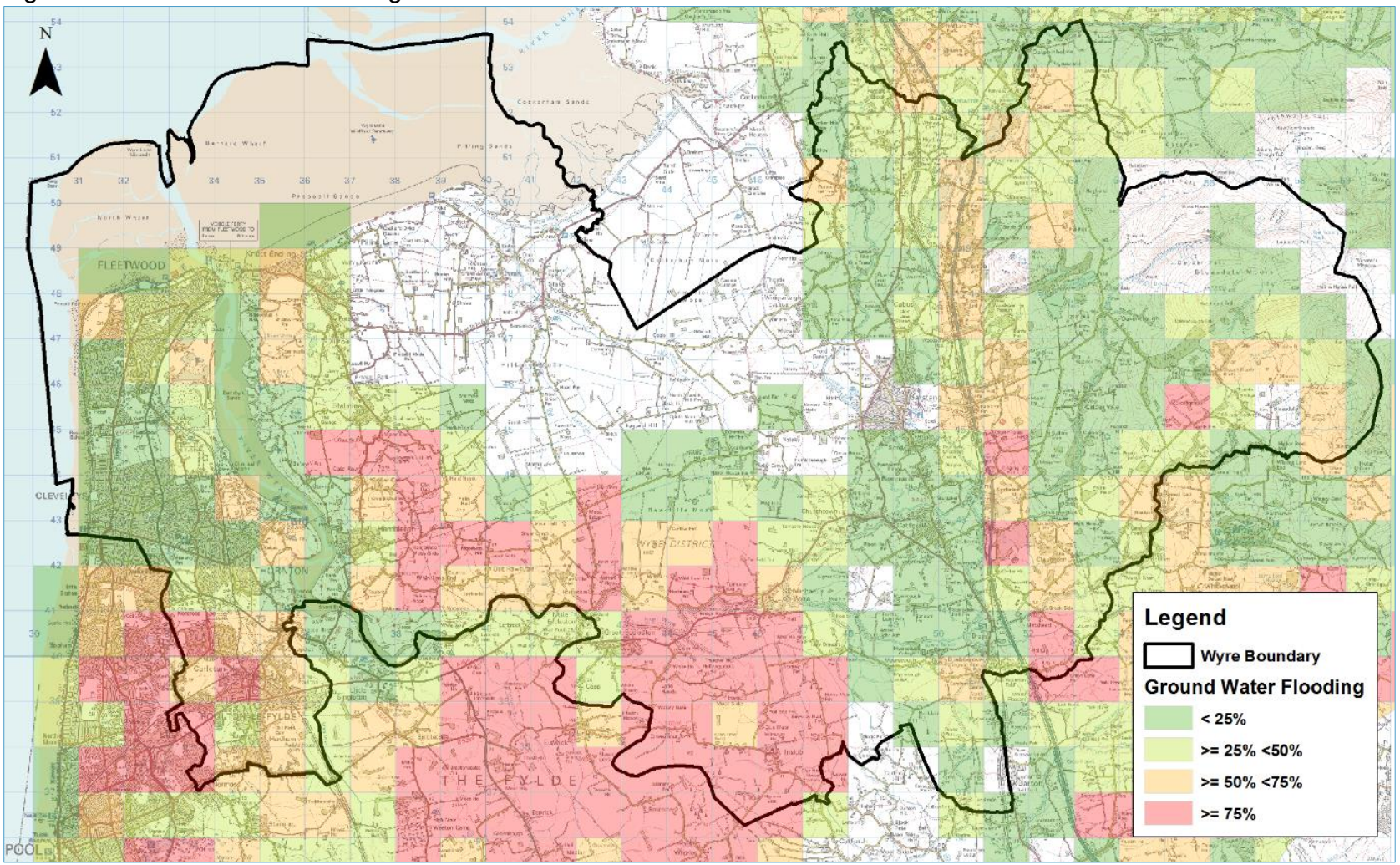
9.10 Groundwater flooding occurs when heavy or prolonged rainfall makes the level of water underground rise above its natural surface. It is most likely to occur in areas underlain by permeable rocks, called aquifers. These can be extensive, regional aquifers, such as chalk or sandstone, or may be more local sand or river gravels in valley bottoms underlain by less permeable rocks. The risk of groundwater flooding can also be exacerbated by artificial factors, such as a reduction in water abstraction.

9.11 Groundwater can have a significant influence on surface water flooding. In particular, in areas where there is a susceptibility to groundwater flooding there is also a lower likelihood of the soil being able to accept much rainfall before becoming saturated.

9.12 The EA have produced a map showing the risk of flooding from groundwater. This map for the study area is shown in Figure 9-3 below. This dataset only identifies wider areas that may be at risk from groundwater flooding. Consequently, given that it covers large areas, it is possible that only isolated locations within the overall susceptible area are likely to suffer the consequences of groundwater flooding.

9.13 Figure 9-3 highlights that the overwhelming majority of Wyre is at a low risk of flooding from groundwater. There are however areas within and adjacent to Great Eccleston, St. Michaels and Inskip which are considered to have a greater susceptibility to ground water flooding. In addition, areas of agricultural land in Over Wyre and to the east of Hambleton may also be at a greater risk of surface water flooding.

Figure 9-3: Groundwater Flooding



Source: Environment Agency

Sewer Flooding

9.14 Sewer flooding normally occurs when inflows into the sewer system exceed the underground system capacity resulting in the sewer system becoming overloaded. When sewers have insufficient capacity to convey all flows during a significant flood event it can result in excess flows being discharged into adjacent drainage systems or surcharged out of the system through overflowing manholes or drains. Flooding from the sewer system can also occur when the outfalls are unable to discharge, due to high water levels in the watercourse / drainage ditches or as a result of insufficient maintenance of riparian owned watercourse / drainage ditches. There is often a greater risk of this occurring where surface water (rainwater) and foul sewage are drained in a single sewer pipe known as a 'combined sewer'. These sewers were largely built before capacity standards were adopted in the 1970s. Furthermore, in many instances, development has occurred since these sewers were built which has increased the flows entering the network. Therefore, it is imperative that all new developments follow the following priority options for the management of surface water discharges to help reduce the risk of flooding:

- Continue and / or mimic the site's current natural discharge process
- Store for later use
- Discharge into infiltration systems located in porous sub soils
- Attenuate flows into green engineering solutions such as ponds; swales or other open water features for gradual release to a watercourse and / or porous sub soils
- Attenuate by storing in tanks or sealed systems for gradual release to a watercourse
- Direct discharge to a watercourse
- Direct discharge to a surface water sewer
- Controlled discharge into the combined sewerage network – this option is a last resort when all other options have been discounted.

9.15 Flooding from combined sewers can be contaminated with sewage and can therefore pose a risk to people's health. To eliminate the risk to "public health" customers should follow the advice notices issued at the time of the incident.

9.16 Sewer flooding can also be caused by a sewer collapsing or a loss of power supply to a pumping station or the failure of mechanical or electrical plant. Infiltration of groundwater into a sewer system can also reduce the capacity of the system and exacerbate the risk of sewer flooding.

9.17 Sewer flooding can also be caused by blockages. The source of blockages can be many and varied but the most common cause of blockages is from a build-up of fats, oils and grease which have been poured down kitchen sinks and sanitary items flushed down the toilet.

9.18 Here are the basics of what not to flush to keep your pipes and drains healthy:

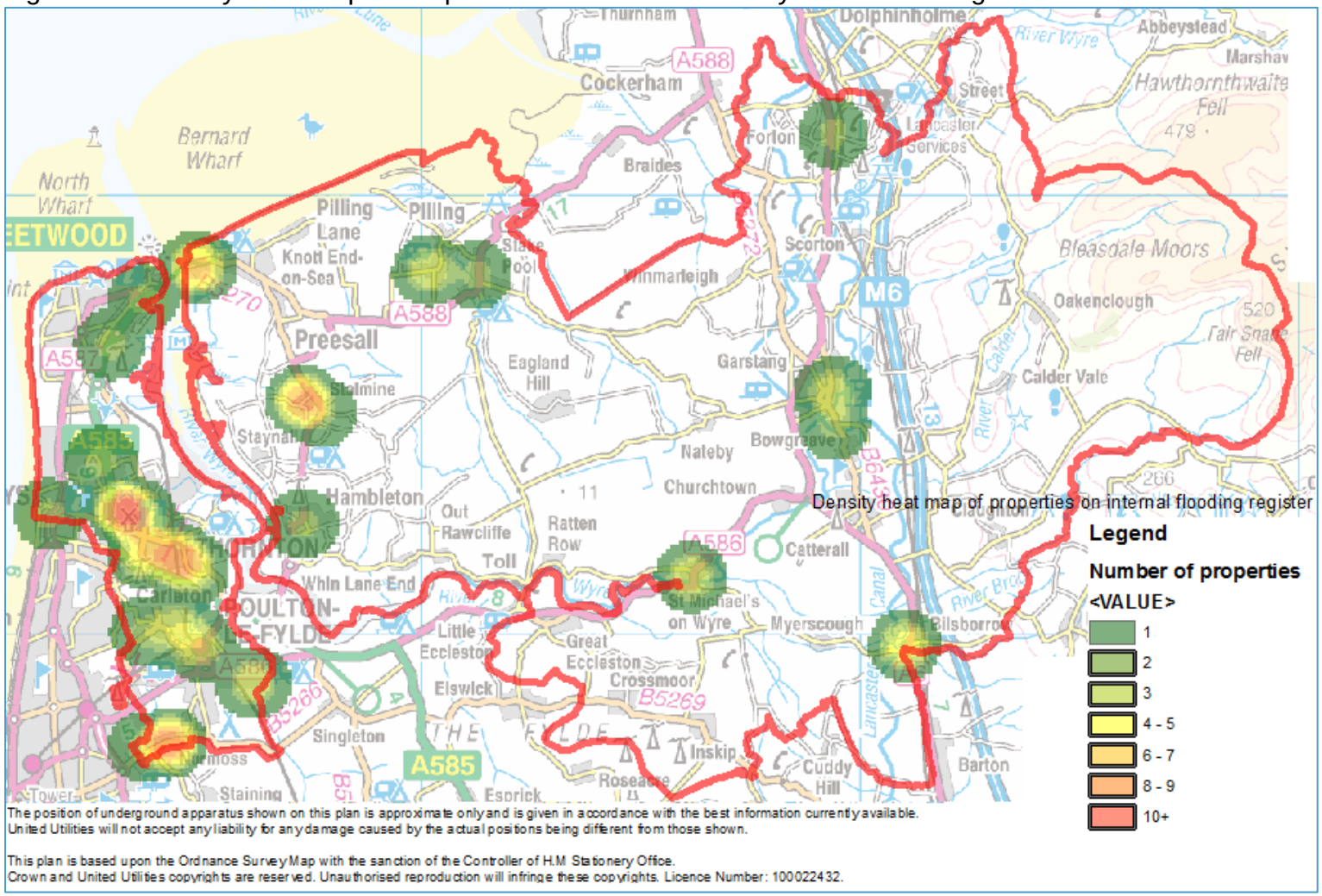
- DON'T pour used oil and fat down the drain;
- DO wait for fats to cool and solidify and dispose in the bin;
- DON'T pour engine oil down the drain;
- DO pour engine oil into a container and take to your local recycling centre;
- DON'T throw plastic razors, sanitary items or medicines down the toilet; and
- DO bag up your bathroom rubbish and dispose in the bin.

9.19 For more detailed information please visit United Utilities website: http://www.unitedutilities.com/thinkbeforeyouflush.aspx

9.20 United Utilities is responsible for the management of sewerage and the sewer system within Wyre. As a result, United Utilities collect data on the incidence of sewer flooding in the Borough. Where sewer flooding does occur it is generally localised to where a blockage or failure of a sewer network takes place. Figure 9-4 does however provide a 'heat map' which depicts the number of properties that have previously been affected by sewer flooding in the Borough.

9.21 As Figure 9-4 demonstrates, sewer flooding incidents have been observed most commonly in the western parts of the Borough, particularly around Thornton, Cleveleys and Poulton-le-Fylde. This is likely to reflect the more urban nature of this part of the Borough, which, due to the greater coverage of impermeable surfaces, increases the volume of surface water run-off entering the sewer system and thereby amplifies the risk that these systems being overwhelmed. In addition, due to the age of urban developments within this area, much of the sewerage infrastructure is likely to be combined.

Figure 9-4: Density Heat Map of Properties at Risk of Internal Hydraulic Flooding



Source: United Utilities

Flooding from Artificial Sources

9.22 There are a number of reservoirs in the Borough - including Grizedale, Barnacre and Grizedale Lea - which provide storage for public water supply.

9.23 For all large storage structures, such as reservoirs, the Reservoirs Act 1975 requires the regular inspection by competent persons to assess the likelihood of failure. Provided that the inspections are carried out regularly and to a high standard, the likelihood of a reservoir failure is considered minimal and the EA's website notes that there has been no loss of life in the UK from reservoir flooding since 1925. Nevertheless, should a reservoir breach occur the impacts could be particularly significant as a large volume of water would escape at once and flooding could happen with little or no warning.

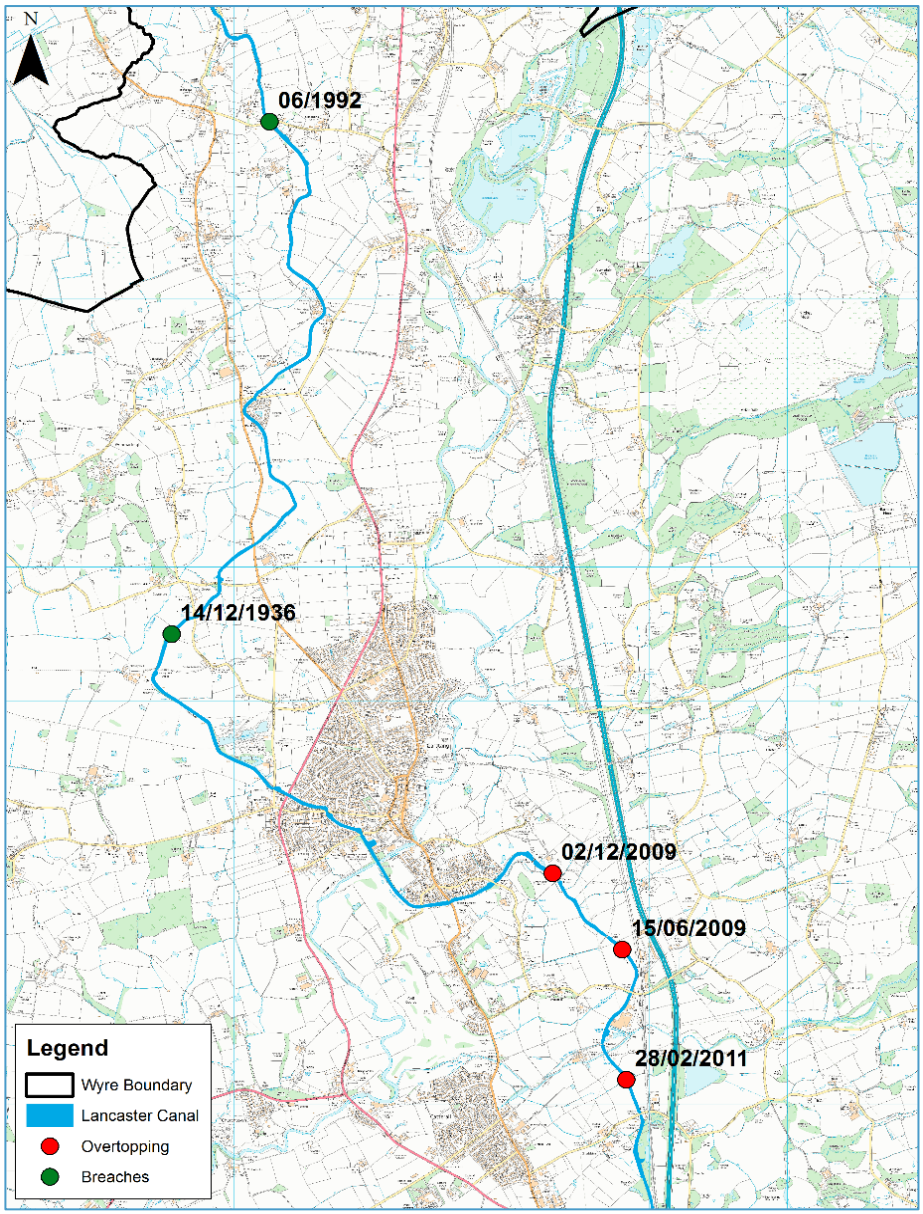
9.24 The EA have produced a map showing the areas in the country that would be at risk in the unlikely event that a reservoir dam failed. The EA's reservoir flooding map for the study area is available on the EA website. This highlights that the areas at risk of reservoir flooding are primarily concentrated in the east of the Borough. Specifically, a significant area to the east of Garstang together with areas to the north and west of Bowgreave and around Churchtown, St. Michaels and Great Eccleston.

9.25 Another artificial source that could present a risk of flooding is canals. Although typically much less variable than rivers, canal water levels can still vary, sometimes quite rapidly, which can lead to canal banks being overtopped. There is also a risk that a canal could be breached. This can be caused by failure of the canal lining and erosion within the embankment slope until failure occurs.

9.26 Lancaster Canal runs almost parallel with the A6 and M6 through the eastern side of the borough between Preston and Lancaster via Garstang. There has been several records of breaches/overtopping occurring on the Lancaster Canal over the years. The locations and dates where these incidents occurred are illustrated in Figure 9-5. This highlights that there have been three occasions when the Lancaster Canal has been overtopped since 2009.

9.27 The Canal and River Trust are responsible for managing the network of canals in England and Wales. Although the Canal and River Trust is not a designated Risk Management Authority within the FWMA, it does have responsibilities for managing their infrastructure to minimise risk to others.

Figure 9-5: Lancaster Canal Flooding



10.0 FUNCTIONAL FLOODPLAIN

10.1 A functional floodplain is a very important planning tool in making space for flood waters when flooding occurs.

10.2 The NPPG states that LPAs should identify areas of functional floodplain in their SFRA taking account of local circumstances. It advises that land which would naturally flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood (such as a flood attenuation scheme) in an extreme (0.1% annual probability) flood, should provide a starting point for identifying the functional floodplain.

10.3 The NPPG also encourages LPAs to take account of the effects of defences and other flood risk management infrastructure when identifying the functional floodplain. It advises that areas which would naturally flood, but which are prevented from doing so by existing defences and infrastructure or solid buildings, should not normally be identified as functional floodplain but states that areas that are intended to flood, such as an upstream flood storage area designed to protect communities further downstream, should be identified as functional floodplain, even if it does not flood very often.

10.4 Within Wyre there are two designated flood storage areas; one at Garstang and the other at St. Michaels/Catterall. These flood alleviation basins were constructed in the 1980s and protect properties in Garstang, Catterall and St. Michaels. Since their construction, there have been several flood events, most notably in 1995 and 2000, where the basins have prevented major flooding to property. Both storage basins are operated by the Environment Agency.

10.5 The Garstang basin utilises the disused Pilling / Knott End railway embankment combined with a new primary embankment and flood control structure. It provides storage of 1.3 million cubic metres (1 million required for the 50 year flood, the remainder acting as a margin of safety) over an area of 89 hectares.

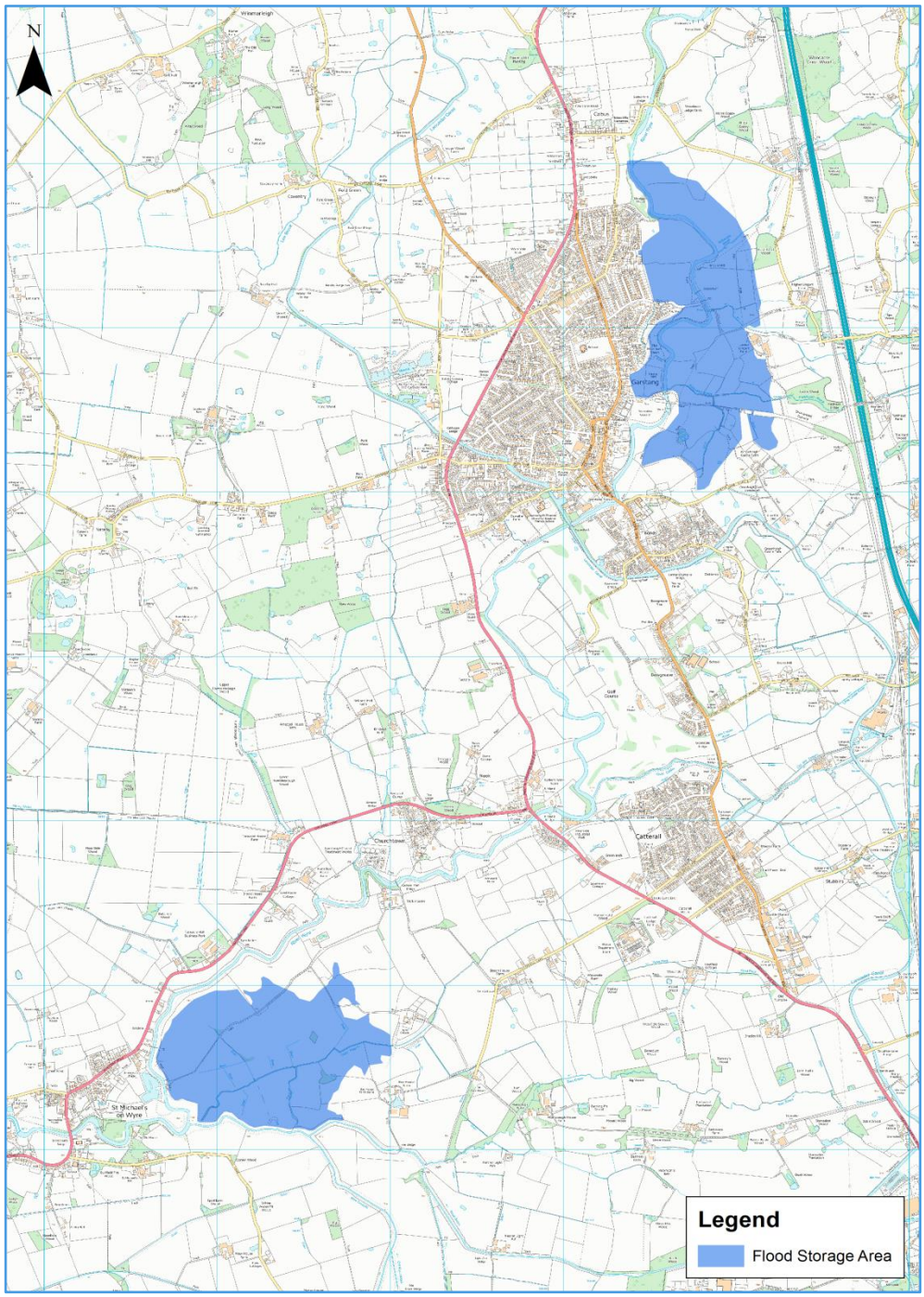
10.6 The basin at St. Michaels/Catterall involves the area between the River Wyre and the River Brock. The basin provides off-line storage of 1.7 million cubic metres (1.3 million required to accommodate the 50 year flood, the remainder acting as a margin of safety) over an area of 92 hectares.

10.7 Figure 10-1 identifies the location of these flood alleviation basins.

10.8 The continued effective and timely operation and optimum use of these flood storage basins is essential for protecting properties within Garstang, Catterall,

Churchtown, St. Michaels and further downstream. As noted above, the NPPG advises that areas designed to flood in an extreme event and upstream flood storage area designed to protect communities further downstream should be identified as functional floodplain. Accordingly, it is considered that both of these designated flood storage areas constitute the functional flood plain.

Figure 10-1: Flood Storage Basins



11.0 FLOOD DEFENCES

11.1 Many Main Rivers and much of the Coastline within Wyre have flood protection in place. Much of the Main River systems are canalised within flood embankments protected to a standard of over 100 years. Similarly the coastal protection offered for the majority of the coast is greater than 200 years. These levels of protection will fall during the plan period due to climate change affected increased rainfall and also sea level rises which will result in beach widths in front of defences narrowing and the defences themselves becoming increasingly exposed and vulnerable. However, plans are in place to enhance the defences in a strategic manner.

11.2 In particular, the Rossall Coast Protection Scheme between Cleveleys and Fleetwood. The current standard of protection is estimated to be 1 in 50 but this is falling due to climate change and the residual life of the seawall is estimated to be approximately 8 years. It has been calculated that the defences are at a risk of breaching during a 1 in 75 year storm which would result in significant flooding of the low lying land behind the defences.

11.3 The Rossall Coast Protection Scheme includes the replacement of 1 km of hard sea wall defences to provide a 1:200 year standard of protection with a design life of 100 years. It will reduce the risk of flooding to the 10,510 residential properties, major highway infrastructure, sewage pumping station and public utilities. The improvements to the coastal defences include a new concrete sea wall and promenade with rock revetments toe protection and rock groynes.

11.4 In addition to these river and coastal flood defences, there is a range of other infrastructure and measures to reduce and manage flood risk in Wyre. This includes flood storage basins at Garstang and St. Michaels/Catterall and a number of pumping stations which protect properties at periods of high tide. The Environment Agency has also established a number of Flood Warning areas within the Wyre Catchment. The purpose of these areas is to provide as much warning as possible to communities of potential flooding. Some of the Flood Warning Areas are located on the coast and within the Wyre estuary and others are located further upstream in the middle of the Wyre Catchment. Within the Borough this provides protection for communities including Cleveleys, Fleetwood, Thornton, Hambleton, Scorton, Garstang, Churchtown, St, Michaels and Great Eccleston.

12.0 CLIMATE CHANGE

12.1 The NPPF states that Local Plans should take account of climate change over the longer term and its accompanying guidance specifies that SFRAs should assess the risk to an area from flooding, now and in the future, taking account of the impacts of climate change.

12.2 It is anticipated that climate change may have a number of significant implications for flood risk. In particular, climate change is expected to result in milder, wetter winters and an increased incidence of short-duration, high intensity rainfall events. Changing sea levels may also impact on flood risk.

12.3 The EA Flood Map and Flood Zones do not currently take account of climate change impacts. It is envisaged that climate change has the potential to increase the extent of areas that are affected by medium and high flood risk. In addition, even if the flood extent did not increase; flooding is likely to become more frequent under a climate change scenario. For example, what is currently an event with a 2% probability of occurring in any one year, may increase to say a 5% probability under climate change. The impact of an event with a given probability may also become more severe due to flood depths or velocities increasing.

12.4 Climate change could have a particularly significant impact on surface water flooding, particularly in areas that are already susceptible to surface water flooding. The impacts on other sources of flooding, such as groundwater flooding, may be more difficult to predict given that wetter winters may exacerbate the risk of groundwater flooding but warmer, drier summers may counteract this effect by drawing down groundwater levels more during the summer months.

12.5 The flood modelling and mapping exercises undertaken as part of this study to determine flood probability areas in the future have taken account of climate change and flood risk management infrastructure over this time period. In particular, the sustainability of potential land use allocations has been assessed, based on what climate change effects may mean for the sites in the long-term.

12.6 Guidance within PPS25 identified a series of sensitivities relating to issues such as rainfall, peak river flows and sea level changes which should be applied for this purpose. This guidance has however now been withdrawn following the publication of the NPPF and the NPPG. The Environment Agency have published a guidance note “Climate Change Guidance for

Planners", this document advises planners on how to incorporate climate change allowances into flood and coastal erosion management.

12.7 Guidance provided by UKCIP instead advises that scenarios (upper, medium and low) for climatic impacts should be applied together with sensitivity analysis around them. This guidance has been taken into account when undertaking the assessments in this SFRA. The assessments have also drawn upon the business case for the Rossall Coast Protection Scheme which provides data covering the next 50 years.

13.0 SCOPING STUDY OF THE BOROUGH

13.1 Drawing upon the information presented in the preceding sections of this report, an initial broad scoping study has been undertaken for the Borough. This provides a broad outline of the key issues for each of the sub catchment areas in Wyre and is presented in Figure 13-1 below:

Figure 13-1: Sub Catchment Areas Scoping Study

Area	Main Source	Main Pathway	Historical Flooding	Notes
Upper Wyre	Flash flooding from overland flows	Rapid runoff from agricultural practices	None recorded, agricultural land with small villages.	Agricultural changes have significant impacts on downstream flows.
Central Wyre	Tidally Influenced fluvial flooding	Combined fluvial and high tide event causing breaching of embankments.	1980 significant flooding to Garstang, Churchtown, St Michaels and Great Eccleston following a fluvial event	Significant improvement works including the construction of two flood storage basins by the EA. Minor flooding caused by backing up of locked secondary watercourses and surface water outfalls
Core Area Upper Estuary	Coastal erosion to frontage, surface runoff and sewer flooding to remainder of area.	Coastal storms causing erosion of defences. High volume of surface water into road gulleys and combined sewer system. Majority of the area is urban and hard landscaped.	Coastal erosion up to early 20th century. Number of reports of sewer and road flooding particularly around the Anchorsholme and Gynn Square areas.	Significant investment has been made in coastal defences on the coastal frontage and to storage facilities on the sewer network.

Core Lower Estuary	Tidal dominated, but also subject to fluvial, ground water and sewer flooding.	Main pathway is a breach in the existing coastal or estuary defences. Other pathways due to blockages and limited hydraulic gradient.	Flood event in 1977 caused flooding to over 2,500 properties following a breach of the tidal defences. Severe storm conditions in December 2013 and January 2014 led to significant damage to the beach management timber groyne structures.	Significant improvements have been made to the coastal defences. A 100 year strategy for improvements to the coastal and estuary defences was completed in 2013. Hillylaid Pool, Royles Brook and the Springfield systems are currently pumped.
Over Wyre Lower Estuary	Tidal dominated, but also subject to fluvial, ground water and sewer flooding.	The main pathway is a breach in the existing sea defences or estuary defences. Other pathways are due to reduced hydraulics within the drainage system and capacity problems in the sewer network.	Flooding occurred to the over Wyre area during the 1977 coastal event. More recently significant overtopping of the defences occurred during the winter of 2013/14, sewer flooding has also occurred around the Pilling and Hambleton areas.	The EA have undertaken considerable improvements to the sea defences in the area. Most recently the Knott End defences were completed in 2015, following a major land gain exercise in the 1970's. Currently beach levels are rising which reduces tidal risks but potentially will cause future problems with the fluvial systems. All are currently gravity systems, with flood assist pumping stations on the Preesall system.

14.0 CONCLUSIONS

14. 1 The outputs from this Level 1 SFRA will be used as the flood risk evidence to support the allocation of land for development in the emerging Local Plan. Allocations for development should be directed towards areas at low risk of flood (Flood Zone 1). Where development cannot be located in Flood Zone 1, the Council will need to review the flood zone maps in more detail to apply the sequential and exceptions test.

14.2 This more detailed assessment of sites will be carried out as part of a Level 2 SFRA. The Level 2 SFRA will consider the detailed nature of the characteristics within a Flood Zone including flood probability, flood depth, flood velocity, rate of onset of flooding and the duration of flooding. Importantly for Wyre the Level 2 SFRA will consider residual flood risk taking into account management measures i.e. flood defences. It will also consider other sources of flood risk.