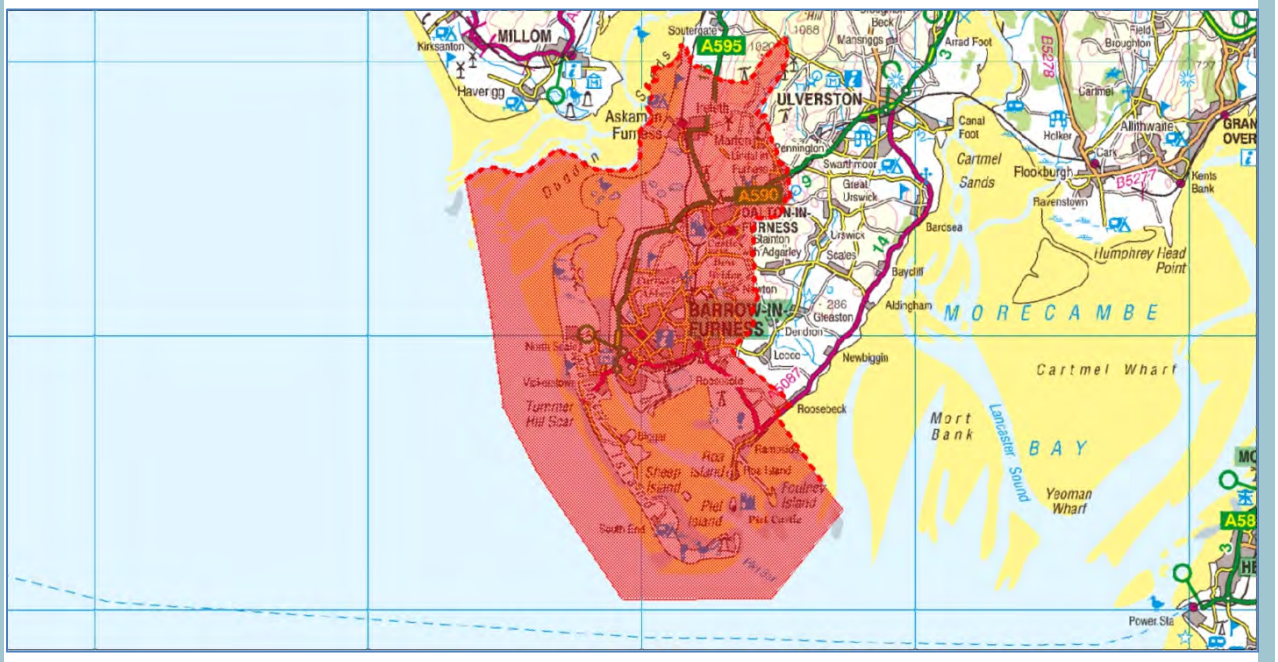
CAPITA

Barrow Borough Council

Strategic Flood Risk Assessment
May 2015



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1. Executive Summary

Capita was commissioned by Barrow Borough Council to prepare a Strategic Flood Risk assessment (SFRA) for the Barrow Borough area in order to inform the Local Plan and the development management process, including the content of site-specific Flood Risk Assessments prepared by developers. The SFRA has been prepared following the latest government guidance and takes into account a wide range of flood risk datasets.

The principal purpose of the SFRA is to examine various datasets relating to flood risk from all sources and produce an assessment of the flood risks throughout the Barrow Borough area. In accordance with guidance the SFRA takes a proportionate approach and draws on existing sources of information, including flood risk modelling supplied by the Environment Agency (EA).

Development should be directed away from areas of highest risk, but where this is not possible, developments should be as safe as possible and not increase flood risk elsewhere. In their Local Plans, Local Authorities should apply the Sequential Test and, where applicable, the Exception Test, as part of a risk-based approach to identifying areas suitable for development. The SFRA facilitates this sequential risk-based approach by identifying the degree of flood risk throughout the Borough.

Within the SFRA, and in conjunction with the EA, a methodology has been developed to produce an easily usable system for identifying flood risk at specific sites. This methodology uses a Geographic Information System (GIS), takes into account all forms of flooding and produces flood risk scores for 100m grid squares. These grid squares are then colour coded in a traffic light system, green, amber or red, depending on the degree of flood risk for that particular square. This allows for an easy visual representation of the coarse flood risk at a specific site and helps to identify where more information may be required for a site specific Flood Risk Assessment.

The SFRA forms an important part of the evidence to inform the development of the Local Plan policies for managing flood risk. Recommendations are, therefore, made within the SFRA on potential planning policies and the approach to development management based on the evidence collated throughout the development of the SFRA.

This is a live document that should be updated as new information and guidance becomes available. Its outcomes and conclusions may not be valid in the event of future changes to legislation, government policy or guidance on flood risk, or if the data on flood risk is updated or changes as a result of future flood risk management measures.

It is the responsibility of the user to ensure that they are using the best available information.

The principal source of flood risk throughout the Borough, based on spatial extents, is surface water flooding. However, parts of the Borough are also at risk from other sources, principally fluvial and tidal flooding, as well as risk from potential reservoir embankment breaches. Fluvial flood risk mainly affects areas along the Poaka Beck/Mill Beck corridor, through Dalton into Barrow and around Blea Beck in Askam. Tidal flood risk exists along the Borough's entire coastline, but the areas mainly affected are the east coast of Walney Island and the area of Rampside and Roa Island.

Where flood risks from different sources coincide the risk is obviously greater and there are a number of areas that have been identified as 'hotspots' due to higher risks arising from a combination of flood sources. These are:

- North of Askam and Ireleth around Marsh Grange – mainly tidal with some surface water risk
- The east coast of Walney Island along the Promenade form North Scale to Jubilee Bridge – mainly tidal with records of historic flooding
- Barrow around Hindpool Road, North Road and Abbey Road – a combination of tidal surface water and groundwater flood risks
- Rampside, Barrow – tidal and surface water
- Central Dalton along the Poka Beck corridor in to Barrow along Mill Beck and into Salthouse – tidal, fluvial, surface water and groundwater flood risks.

2. Introduction

2.1 What is a Strategic Flood Risk Assessment?

Strategic Flood Risk Assessments (SFRAs) are studies that are undertaken by planning authorities to assess the risk of flooding, from all sources, within the authority's area. The study takes account of all available sources of information on flooding and includes the predicted impacts of climate change on future flood risks. The completed SFRA is used within the planning and development control decision making process and supports the Sustainability Appraisal of the Local Plan.

Guidance on the preparation of the SFRA is set out in the National Planning Policy Framework (2012) (NPPF). In line with this guidance the SFRA takes a proportional approach on collecting information on which to base the assessment of flooding. This evidence is drawn from existing sources, including other studies and data available from other organisations, such as the Environment Agency (EA). The SFRA looks at the probability and consequences of flooding, taking account of any flood defences already in place and determines whether development sites are at risk from flooding, whether they may increase flood risk elsewhere and whether they can provide a reduction in flood risk.

2.2 Why do Local Authorities need SFRAs?

Local Planning Authorities (LPAs) are required to prepare a Local Plan for their area, to set out the vision and aspirations of the local community and the policies that will help deliver sustainable development to support these. The Local Plan needs to be based on adequate, up-to-date and relevant evidence on the economic, social and environmental characteristics of the area and this evidence base includes a SFRA. When considering flooding during the planning process LPAs apply what is known as the Sequential Test and, where applicable, the Exception Test. These tests are considered in the SFRA and applied to potential development sites to determine whether they are at risk from flooding and, if so, to what degree.

There is an assumption that development will be avoided in areas that are at high flood risk, but where development is necessary, the SFRA helps to ensure that it is safe and does not increase flood risks elsewhere.

2.3 Background

The National Planning Policy Framework (NPPF) and accompanying online Planning Practice Guidance (http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/) replace a number of Planning Policy Statements (PPS) and Guidance Notes, including PPS25: Development and Flood Risk and PPS 25 Supplement: Development and Coastal Change. However, the PPS25 Practice Guide: The Assessment of Flood Risk (The Practice Guide) has not been replaced and is still in use. It should be noted that where the Practice Guide refers to PPS25 that reference is no longer valid and where there is a conflict with NPPF then NPPF takes precedence.

The NPPF states that LPAs should "…use Strategic Flood Risk Assessment to inform their knowledge of flooding, refine the information on the flood map and determine the variations in

flood risk from all sources of flooding across their area. These should form the basis for preparing appropriate policies for flood risk management for these areas." In line with the NPPF the Council will use the SFRA to inform the Sustainability Appraisal of the forthcoming Barrow-in-Furness Local Plan.

The NPPF online Planning Practice Guidance provides supporting information on the application of the Sequential Test and the Exception Test and provides guidance of what should be included in the SFRA and in site specific Flood Risk Assessments (FRAs), which are generally prepared by developers for their sites. The Online Planning Practice guidance also provides figures to be used when assessing the predicted effects of climate change on sea level rise, river flows, rainfall intensity and wind speed and wave height.

As well as the changes to national planning policy there have been a number of legislative changes in relation to flood risk. These include the publication of the Flood Risk Regulations 2009, which enacts the EU Floods Directive in England and Wales and the Flood and Water Management Act 2010, which places new responsibilities on Lead Local Flood Authorities (LLFAs). The LLFA for Barrow is Cumbria County Council.

In addition to these national policy and legislative changes there is a great deal of information available on flooding that should be included in the SFRA. The EA has published flood zone mapping that shows areas where flooding is predicted to occur. The EA has also published the Areas Susceptible to Surface Water Flooding (AStSWF) dataset, which provides an indication of areas at risk of surface water flooding from a storm event with a 1 in 200 year probability. This was followed by a Flood Map for Surface Water (FMfSW), which is similar, but which considers different storm durations and return periods (1 in 30 as well as 1 in 200 year probability). In addition the EA has also published its Area Susceptible to Groundwater Flooding (AStGWF) dataset, which provides a coarse indication of groundwater flood risk.

As well as the data available from the EA, Barrow BC liaises closely with United Utilities (UU), who keep a database of sewer flooding incidents, and with Cumbria County Council (CCC), who are the Highway Authority and Lead Local Flood Authority (LLFA).

2.4 SFRA Preparation Process

Table 2.1 below shows the basic SFRA process that is being undertaken by Barrow Borough Council to provide a proportionate evidence base in line with the guidance in the NPPF and the associated Technical Guide, and that will allow the development of an appropriate development strategy and planning policies for the Borough.

Stage	Activity
1	Planning the assessment (establishing what is required)
2	Development of assessment methodology in consultation with the Environment Agency
3	Data gathering and mapping
4	Initial assessment of mapped data
5	Identification of sites that require more detailed assessment
6	Identification of any other significant issues
7	Review of the provisional results in consultation with the Environment Agency

8	Identification of key findings
9	Identification of key issues for consideration in the Local Plan
10	Production of the completed assessment (this document)
11	Monitoring/informing development control decision making/informing plan preparation

Table 2-1 SFRA preparation process

Each of these stages is detailed below.

Stage 1: Planning the Assessment (establishing what is required)
The NPPF, the Technical Guide and the Practice Guide outline what the SFRA should seek to achieve, namely:

- Avoid inappropriate development in areas at risk from flooding
- Direct new development away from areas at highest risk of flooding
- Ensure that, where new development is necessary in areas at risk from flooding, that they can be made safe
- Avoid increased flood risk, either at the location of the development, or elsewhere, as a result of new development

The NPPF Technical Guide defines areas at risk of flooding as "land within Flood Zone 2 and 3; or land within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency", and defines flood risk as the "risk from all sources of flooding – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals, lakes and other artificial sources".

Flood Zones are defined by the EA and are published as Flood Maps which can be viewed on the EA website at:
http://watermaps.environmentagency.gov.uk/wiyby/wiyby.aspx?&topic=floodmap#x=357683&y=355134&scale=2.

Flood Zones refer to flooding from rivers and the sea only and do not take account of any existing flood defences. Zone 1 has the lowest probability of flooding and Zone 3 the highest. The NPPF Technical defines these Flood Zones, sets out for each zone the uses considered appropriate, the flood risk assessment requirements and the advocated planning policy aims.

The NPPF requires site-specific Flood Risk Assessments (FRA) for all development proposals of 1 hectare or greater in Zone 1, all proposals in Zones 2 or 3 and proposals in Zone 1 where there have been critical drainage problems and where proposed development or a change of use to a more vulnerable class may be subject to another source of flooding. The Purpose of the site-specific FRA is to ensure that development will be safe for its lifetime, taking into account the vulnerability of its users, without increasing flood risk elsewhere and, where possible, reducing flood risk overall. It should identify and assess the risk from all sources of flooding and how these will be managed so that the development remains safe throughout its lifetime and taking the predicted effects of climate change into account.

The SFRA needs to include sufficient detail to allow the Sequential and Exception Tests to be applied to sites identified for development.

Stage 2: Development of Detailed Assessment Methodology in Consultation with the EA
The assessment methodology has been developed in consultation with the EA and is based on guidance from the NPPF, the Technical Guide and the remaining extant portions of the Planning Policy Statement (PPS) Practice Guide.

Stages 3 to 11, as described below, set out the methodology agreed with the EA for the SFRA assessment process.

Stage 3: Data Gathering and Mapping
In line with the guidance, the first stage of the SFRA is a desk-based study, the purpose of which is to draw together all relevant available information in relation to flooding. A brief description of the sources of data used for this SFRA is given below.

- EA Flood Zone Mapping – the EA Flood Maps are produced from a combination of computer modelling and historic flood event data, which are informed by studies, detailed models, monitoring and other flooding information. The EA has an ongoing programme of improving and revising the Flood Maps and updates are made quarterly. The areas shown as at risk of flooding on the Flood Maps do not take account of existing defences. There are 4 Flood Zones shown on the maps, which range in probability of flooding, from Zone 1, the lowest to Zone 3, the highest. Zone 3b is the functional flood plain where water has to flow or be stored in times of flood.
- Historic Flood Data – data from historic floods is used by the EA in preparation of Flood Maps, but due to limitations in the data recorded and its accuracy it is only indirectly useful in assessing flood risk for the SFRA.
- Sewer Flooding – historic data on sewer flooding incidents has been provided by United Utilities
- Surface Water and Groundwater Flooding – EA has published the Areas Susceptible to Surface Water Flooding (AStSWF) dataset, which provides an indication of areas at risk of surface water flooding from a storm event with a 1 in 200 year probability. This was followed by a Flood Map for Surface Water (FMfSW), which is similar, but which considers different storm durations and return periods (1 in 30 as well as 1 in 200 year probability). In addition the EA has also published its Area Susceptible to Groundwater Flooding (AStGWF) dataset, which provides a coarse indication of groundwater flood risk.
- Reservoir Inundation – EA has published reservoir flood maps, which can be viewed on their website and which show the worst-case scenario if a reservoir were to burst its banks and release the water it holds. As this is a worst case scenario it is unlikely that any actual area flooded would be as large as that shown on the maps. In any case reservoirs are closely monitored to ensure their safety and structural integrity. There are four reservoirs within the Borough, Ormsgill, Thorncliffe, Cavendish Dock and Poaka Beck. Harlock Reservoir sits outside of the Borough, but its possible flood area overlaps the Borough and as such it is considered in the SFRA in conjunction with Poaka Beck reservoir due to their close proximity.
- Flood Defences – Flood defences are generally raised structures that control the flow of flood waters and are classified into two broad categories, as either ‘formal’ or ‘informal’. Formal flood defences are those that have been constructed specifically for the purpose of controlling flood waters. Informal flood defences are those structures or other items which may provide some degree of flood protection as a secondary effect, e.g. a boundary wall adjacent to a river. Flood defence data for formal defences is collected and maintained by EA in its National Flood and Coastal Defence Database (NFCDD).

The available flood risk data has been collated and mapped on the Council's mapping system by displaying it based on a 100m square grid that aligns with the Ordnance Survey National Grid. Where the mapped flood risk data intersects with any grid square the square will appear shaded. The colour of the shading is based on a weighting system that scores each flood dataset according to the likelihood and potential severity of flooding. The weighting has been developed in consultation with the EA and the datasets, weightings and possible maximum scores for each dataset is shown in Table 2.2 below.

Dataset	Weighting	Max. Score
Flood Zone 2	No intersection = 0 Intersects = 10	10
Flood Zone 3	No intersection = 0 Intersects = 10	10
Historic Flood Area	No intersection = 0 Intersects = 3	3
Reservoir Inundation	No intersection = 0 For each reservoir (excluding Poaka/Harlock) = 2 Poaka/Harlock = 4	10
Areas Susceptible to Groundwater Flooding	No intersection = 0 Less than 25% = 2 25% to 50% = 5 Greater than 50% = 10	10
Areas Susceptible to Surface Water Flooding	No intersection = 0 Less than 25% = 2 25% to 50% = 5 Greater than 50% = 10	10
	Total	**53**

Table 2-2: Flood risk assessment dataset weightings and scores

The total maximum score that a grid square can attract is 53. Scores have been aggregated into three bands to form a 'traffic light' system for easy visual recognition. Band 1, shaded green, covers scores from 1-9, Band 2, shaded amber, covers scores 10-24 and Band 3, shaded red, covers scores 25-53. Where the grid square does not intersect with any dataset, i.e. the score is zero, the square will remain unshaded.

It should be noted that this mapping system is to be used as an indicative tool due to the coarse size of the grid used and as such will not provide detailed flood risk assessment for any specific area. An amber or red shaded square does not necessarily have a greater flood risk than a green shaded square, as intersections may not overlay each other and intersections may only represent a very small area within the grid square. Therefore, results from the mapping system should be considered as a starting point only.

Stage 4: Initial Assessment of Mapped Data
Assessment initially involves identification of areas with low, medium and high flood risk as defined by the scoring system. This does not take into account flood defences and purposely produces a worst case scenario, for example if defences were to fail. The protection afforded to areas by flood defences will be assessed for specific sites identified for more detailed assessment. The mapping system will, therefore, produce a broad brush assessment of flood risk from all sources across the Borough.

Subsequently, sites that have been allocated for development within the saved local planning policy will be overlaid on the map to assess their initial flood risk and to identify sites that require more detailed assessment, i.e. those that are amber or red.

Stage 5: Identification of Sites that Require Further Assessment
Sites that have been identified as requiring further assessment will be examined in greater detail to ascertain the type and extent of flooding that effects the relevant grid square(s), specifically within the site boundary. It may be that while a dataset overlaps the grid square it does not also overlap the site boundary and in such a case the score for the site will be less than that of the bounding grid square(s). As such, following detailed assessment some sites may be classified as a lower risk and any sites that are re-classified as green will not be assessed further.

Once the need for further assessment has been confirmed, each site will be assessed with regard to any existing flood defences, as well as the type and degree of possible flooding. Possible mitigation measures will also be indentified following further consultation with EA. Possible requirements for site specific FRAs will be identified for future communication to developers.

Stage 6: Identification of Significant Issues
Sites identified for further assessment will also be considered with regard to climate change impacts, specific flood hazards (i.e. vulnerability of site users) and to identify possible residual flood risks.

Stage 7: Review of Provisional Results in Consultation with the EA
Once all sites have been assessed further consultation will be undertaken with the EA to finalise the results.

Stage 8: Identification of Key Findings
Once the preceding stages have been completed key findings will be identified for inclusion in the SFRA. These will include, identified flood risk hotspots and assessment results for allocated sites.

Stage 9: Identification of Key Issues for Consideration in the Local Plan
Following identification of key findings, key issues will be considered for inclusion in the Local Plan. These will include implications for future allocations and development in flood risk hotspots, opportunities to reduce flood risk and implications for emergency planning.

Stage 10: Production of the Completed SFRA
This stage covers the production of this report and associated appendices.

Stage 11: Monitoring and Future Use of the SFRA
The completed SFRA contains recommendations for future monitoring and guidance on how the SFRA can be applied to both strategic planning and development control decisions. The SFRA is intended to be a ‘living document’ and as such will be regularly updated as new information on flood risk is identified. The mapping based tool used for site assessment will also be updated as new datasets become available.

3. Legislative and Planning Framework

3.1 Legislation

Flood Risk Regulations, 2009
The Flood Risk Regulations, 2009 came into force on the 10th December 2009 and transpose the European Union Floods Directive (Directive 2007/60/EC on the assessment and management of flood risks) into domestic law in England and Wales and implement its provisions.

The Regulations define a Lead Local Flood Authority (LLFA) to be a unitary or county authority for the area, so for Barrow Borough this is Cumbria County Council (CCC). The Regulations also place duties upon the EA and LLFAs to prepare a number of documents over an ongoing 6-year cycle. These documents include:

- Preliminary Flood Risk Assessments (PFRAs) – consisting of preliminary assessment maps and preliminary assessment reports
- Flood hazard and flood risk maps
- Flood risk management plans

As part of the requirement to prepare PFRAs, the Regulations placed a duty on the EA to identify Flood Risk Areas within each river basin district that are at significant risk of flooding from the sea, main rivers and reservoirs, which is available on the EA's website in the form of its flood maps and reservoir inundation maps. Flood Risk Areas are defined as and area or 'cluster' of areas where flood risk is an issue and where at least 30,000 (in England, 5,000 in Wales) people are at risk of flooding.

The Regulations also place a duty on LLFAs to determine in the production of its PFRA whether there is a significant risk of flooding from other sources, i.e. ordinary watercourses, surface water, groundwater and artificial sources such as canals, and to identify where these flood risk areas are located.

CCC has prepared a PFRA for Cumbria, but as no Flood Risk Areas have been identified flood hazard and flood risk maps and the subsequent flood risk management plans will not be produced.

Flood and Water Management Act, 2010
The Flood and Water Management Act, 2010 places significantly greater responsibility on Local Authorities to manage and lead on local flooding issues.

The Act sets out the requirements and targets that LLFAs and other flood risk management authorities need to meet with regard to local flood risk management, including:

- The need for LLFAs to play an active role leading flood risk management
- A requirement for LLFAs to develop Local Flood Risk Management Strategies (LLFRMS)
- Cooperation between relevant authorities with regard to flood risk and coastal erosion, including the sharing of information

- The responsibility of LLFAs to investigate flooding incidents within their areas to the extent that they consider necessary
- The duty of LLFAs to maintain a register of structures and features which may affect flood risk within their areas including information on ownership and maintenance responsibility and the current state of repair, and
- The Act enables the EA and local authorities to designate structures, such as flood defence embankments, owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent.

The Flood and Water Management Act also clarifies key areas that influence development:

- Sustainable Drainage (SuDS) – the Act makes provision for a national standard to be prepared for SuDS. Developers will be required to obtain local authority approval for SuDS in accordance with the standards.
- Permitted flooding of third party land – the EA and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage to people's enjoyment of the environment or cultural heritage.

The Act reinforces the requirement to manage flood risk holistically and in a sustainable manner and follows the key principles within Making Space for Water (Defra, 2005) and was further bolstered by the summer 2007 floods and the Pitt Review (Cabinet Office, 2008). It implements several of the key recommendations of the Pitt Review.

Planning Legislation, including Town and Country Planning Act, 1990 (as amended) and Planning and Compulsory Purchase Act, 2004
Local planning authorities, such as Barrow Borough Council, must prepare development plans and manage development within their areas. Local Plans must be prepared with the objective of contributing to the achievement of sustainable development. Development management decisions must be taken in accordance with the development plan unless material considerations indicate otherwise.

3.2 National Planning Policy

National Planning Policy Framework, 2012
The National Planning Policy Framework (NPPF) was issued in March 2012 and outlines national development policy including in relation to flood risk. NPPF replaced with immediate effect previous policy, including Planning Policy Statement (PPS) 25 – *Development and Flood Risk*.

NPPF requires the Local Plan to be supported by a Strategic Flood Risk Assessment (SFRA) and to develop policies to manage flood risk from all sources. In developing policies Local Plans should apply a sequential risk-based approach to the location of development in order to avoid flood risk to people and property, to manage any residual risk and to take account of the predicted impacts of climate change.

Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The

SFRA will be the basis for applying the Sequential Test and this approach should be taken in areas known to be at risk from any form of flooding.

Following application of the Sequential Test, if it is not possible for the development to be located in zones with a lower probability of flooding the Exception Test should be applied. It should only be applied if appropriate to the type of development and if consistent with wider sustainability objectives.

For the Exception Test to be passed it must demonstrate that the development provides wider benefits to the community that outweigh the flood risk, informed by the SFRA. It must also be demonstrated within a site-specific Flood Risk Assessment (FRA) that the development will be safe for its lifetime without increasing flood risk elsewhere, and where possible reducing flood risk.

When determining planning applications, Local Planning Authorities should ensure that flood risk is not increased elsewhere and should only consider development in areas at risk of flooding where it can be demonstrated that a sequential approach has been taken, that the development is appropriately flood resilient, that residual risks can be managed and that priority is given to the use of SuDS.

Planning Practice Guidance to the National Planning Policy Framework, 2012
The Online Planning Practice Guidance (http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/) to the NPPF provides additional guidance to Local Planning Authorities to ensure the effective implementation of the planning policy set out in the NPPF on development in areas at risk of flooding. It provides supporting information on:

- The definition of Flood Zones
- Flood risk vulnerability of different land uses
- The application of the Sequential and Exception Tests
- Flood risk assessment at the strategic and site level, and
- Climate change and managing residual risks

The Planning Practice Guidance clarifies that the SFRA should also:

- Refine information on the probability of flooding by taking into account information on other sources of flooding and the effect of climate change
- Support the Local Plan
- Be prepared in consultation with the Environment Agency, the LPA's own emergency planning and drainage functions and any Internal Drainage Boards
- Inform appropriate flood risk management policies and the sustainability appraisal of the development plan documents, and
- Form the basis of applying the Sequential and Exception Test in the development allocation and development control processes.

3.3 Local Planning Policy

Current local planning policy consists of:

- The saved policies of the Barrow-in-Furness Borough Council Local Plan Review 1996-2006 (Local Plan Review) – adopted in August 2001
- The saved policies of the Barrow-in-Furness Borough Council Local Plan Review 1996-2006 Housing Chapter Alteration (HCA) 2006 – adopted June 2006, and
- The Barrow Port Area Action Plan (BPAAP) Development Plan Document – adopted July 2010.

Barrow Borough Council is currently in the process of developing a new Local Plan document that will, in due course, replace the current saved policies from the abovementioned plans. The first two plans will be replaced in their entirety, with the BPAAP being retained, with specific policies being revised/replaced as necessary. The Plan will be Borough-wide and will include land allocations and detailed development control policies.

This SFRA will form one of a number of documents that will act as an 'evidence base' to the Local Plan, to inform the process and ensure that the strategy, allocations and policies are the most appropriate for the Borough. For the SFRA in particular, this will include ensuring that development is steered away from areas that are most vulnerable to flooding and that opportunities to reduce flood risk are taken where possible.

3.4 Other Strategies, Plans, Assessments and Guidance Documents

The SFRA will be an important tool in deciding land use and development and planning polices, and as such it is essential for it to take into account information and best-practice from other strategies, plans, assessments and guidance documents. The following sections start from a national perspective and then deal with regional, sub-regional and local documents.

UK Climate Impact Programme (UKCIP09), 2009
In June 2009 the UKCIP09 released new guidance with respect to climate change predictions. The predictions moved from a deterministic approach (i.e. one of a range of outcomes) to a probabilistic approach (i.e. a range of possible outcomes based on a range of climate change scenarios). The results indicate that based on a central estimate of likely outcomes (i.e. 50th percentile), increases in rainfall are expected to remain similar to those predicted by UKCP02, which are the figures used in this SFRA. A high estimate of likely outcomes (i.e. 95th percentile) could result in significantly more intense rainfall than at present.

The EA has recently released its advice to Flood and Coastal Risk Management Authorities on Adapting to Climate Change, which replaces previous advice and is specifically intended to be applied to projects seeking Flood Defence Grant in Aid (FDGiA) from the Government with submission dates from January 2012. While this can be viewed as the latest guidance, it does not specifically apply to SFRAs and as such the guidance in the NPPF will be used for this SFRA. However, for comparison a brief précis of the EA guidance included.

The EA guidance recommends that assessments are based on a change factor that quantifies potential change (in millimetres or % terms) from the baseline. Upper, lower and what are termed H^{++} values, are provided to enable a range of estimates to be assessed over the lifetime

of a scheme. The H^{++} scenario is an estimate of change beyond the likely range but within physical possibility and is useful for contingency planning.

With respect to the North West of England Table 3.1 shows the recommendations for increases in river flows.

Scenario	Total potential change anticipated for the 2020s	Total potential change anticipated for the 2050s	Total potential change anticipated for the 2080s
Upper end estimate	25%	35%	65%
Change factor	15%	20%	30%
Lower end estimate	5%	10%	10%
H^{++} estimate	40%	60%	105%

Table 3-1: Changes to river flows compared to a 1961 to 1990 baseline - NW England

With respect to rainfall intensity and extreme rainfall Table 3.2 applies to total daily rainfall and not to sub-daily intervals. These figures should be applied to return periods less frequent than the 1 in 5 annual probability event. For events more frequent than this there is further guidance in UKCP09.

Scenario	Total potential change anticipated for the 2020s	Total potential change anticipated for the 2050s	Total potential change anticipated for the 2080s
Upper end estimate	10%	20%	40%
Change factor	5%	10%	20%
Lower end estimate	0%	5%	10%

Table 3-2: Changes to total daily rainfall - all England

CIRIA C697 The SUDS Manual, 2007
This guidance, published by the Construction Industry Research and Information Association (CIRIA), provides best practice guidance on planning for, designing, constructing, operating and maintaining Sustainable Urban Drainage Systems (SUDS) to facilitate their effective implementation within developments.

The guidance supersedes previous general guidance on SUDS and addresses landscaping, biodiversity issues, public perception and community integration as well as water quality treatment and sustainable flood risk management. The output is based on results from the EA R&D Report SCO20114/2.

CIRIA C635 Designing for Exceedance in Urban Drainage: Good Practice, 2006
This guide aims to provide best practice advice to designers and managers of urban sewerage and drainage systems to reduce the issues arising from exceedance of capacity. The guide includes advice on risk assessment procedures and planning that can reduce the impact of exceedance events to those at risk.

WRc, Sewers for Adoption 7th Edition, 2012
This document is the definitive guide for those planning, designing and constructing sewers and pumping stations for subsequent adoption by water companies in England and Wales under Section 104 of the Water Industry Act.

Additionally, the guidance includes best practice on planning, designing, constructing, operating and maintaining SUDS within developments. It also extends the guidance to cover smaller sewers and lateral drains that have been brought under the management of water companies through the Flood and Water Management Act, 2010.

CLG Improving Flood Performance of New Buildings: Flood Resilient Construction, 2007
This Government document, published by Communities and Local Government (CLG), provides developers and designers with guidance on improving the flood resilience of new properties in low or residual flood risk areas. It covers the use of suitable materials and construction details and supports a general hierarchy of building and site design where it is not possible to avoid construction in areas at flood risk:

- Flood Avoidance – design and construction to avoid a site being flooded
- Flood Resistance – design and construction to prevent flood water from entering the building or fabric
- Flood Resilience – design and construction to reduce any permanent damage and to facilitate drying and cleaning post-flood, and
- Flood Repairable – design and construction such that damaged elements can be easily repaired or replaced.

Defra Draft National Standards for SuDS, 2011
The Draft National Standards for Sustainable Drainage Systems (SuDS) in England were developed to be used in order to manage surface runoff in accordance with Schedule 3 of the Flood and Water Management Act, 2010. The key objectives are to manage the flow rate and volume of surface runoff to reduce the risk of flooding and water pollution. SuDS can also reduce pressure on the sewerage network and can improve local biodiversity and amenity.

The Draft National Standards set out how design and construction of SuDS should be undertaken to obtain approval from the SuDS Approving Body (SAB) and what is required for operation and maintenance of SuDS that the SAB adopts. For Barrow the SAB is Cumbria County Council.

The Draft National Standards also state that Local Planning Authorities may set local requirements for planning permission for SuDS that are more stringent than the National Standards guidance.

At the time of writing a date for the final implementation of the draft standards and the SAB process has not yet been set by Defra and a further consultation on the implementation of SuDS was underway and due to be completed in October 2014. Due to this process there is no firm date for when the final SuDS standards will be published.

North West England and North Wales Shoreline Management Plan, 2011
In February 2011, Halcrow Group Ltd consultants completed the revision of the Shoreline Management Plan (SMP2) for Sub-cell 11c: Rossall Point to Haverigg, which includes Barrow's coastline. SMP2 provides a large scale assessment of the risks associated with coastal flooding and erosion and is intended to inform wider strategic planning policies.

SMP2 sets out preferred policies for individual lengths of coastline taking into account a wide range of possible impacts, including environmental, social, economic, etc. Policies are set out for three epochs: short term (present to 2025), medium term (2025 to 2055) and long term (2055 to 2105).

The preferred policy will suggest one of four courses of action for each individual length of coastline, as follows:

- Hold the Line – to maintain or change the current standard of protection, including work both in front of and behind existing defences to maintain the current coastal defence system,
- Advance the Line – involves building new defences on the seaward side of the existing defences and is restricted to areas where considerable land reclamation is considered,
- Managed Realignment – allowing the shoreline to move backwards or forwards and may involve building new defences or breaching, or allowing to breach, existing defences, or removal of existing defences,
- No Active Intervention – no investment in coastal defences. No defences will be constructed, but monitoring of coastal processes will continue.

The SMP2 policies for the Barrow Borough coastline are shown in Table 3.3.

Location (policy unit)		Policy and Approach		
		Present to 2025	2025 to 2055	2055 to 2105
Bardsea to Piel Island				
13.2	Newbiggin to Rampside	**Hold the Line** – manage risk to the main road by maintaining existing defences to an adequate standard. Investigate opportunities for setback defences in the medium term. Economic justification for realigning or re-routing the road should be considered	**Managed Realignment** – depending on the outcome of studies, construct setback defences or realign road where appropriate, elsewhere manage flood risk by maintaining existing defences to an adequate standard	**Hold the Line** – manage flood risk by maintaining setback/other defences to an adequate standard.
13.3	Rampside	**No Active Intervention** – Limited defences present, allow natural processes to continue. However, localised defences may be permitted, subject to consent	**Hold the Line –** when flood risk justifies intervention	**Hold the Line –** when flood risk justifies intervention

13.4	Roa Island	**Hold the Line –** Manage flood and erosion risk by maintaining existing defences to an appropriate standard.	**Hold the Line –** Manage flood and erosion risk by maintaining existing defences to an appropriate standard.	**Hold the Line –** Manage flood and erosion risk by maintaining existing defences to an appropriate standard.
13.5	Piel Island	**No Active Intervention –** Limited defences present, allow natural processes to continue. However, localised defences may be permitted, e.g. Piel Castle	**No Active Intervention –** Limited defences present, allow natural processes to continue. However, localised defences may be permitted, subject to consent	**No Active Intervention –** Limited defences present, allow natural processes to continue. However, localised defences may be permitted, subject to consent
Walney Island				
14.1	South End Hawes (east side)	**No Active Intervention –** investigate whether it is feasible to withdraw from maintenance and allow natural processes to continue	**No Active Intervention –** subject to investigations, allow limited local defences to fail and natural processes to continue	**No Active Intervention –** subject to investigations, allow limited local defences to fail and natural processes to continue
14.2	Biggar to Lenny Hill (east side)	**Hold the Line –** manage flood and erosion risk by maintaining existing defences	**Hold the Line –** manage flood and erosion risk by maintaining existing defences	**Hold the Line –** manage flood and erosion risk by maintaining existing defences
14.3	South End Hawes to Hare Hill (open coast)	**No Active Intervention –** no defences present, allow natural processes to continue	**No Active Intervention –** no defences present, allow natural processes to continue	**No Active Intervention –** no defences present, allow natural processes to continue
14.4	Hare Hill to Hillock Whins	**Hold the Line –** manage flood and erosion risk to sea defence at landfill sites and maintain integrity of island	**Hold the Line –** manage flood and erosion risk to sea defence at landfill sites and maintain integrity of island	**Hold the Line –** manage flood and erosion risk to sea defence at landfill sites and maintain integrity of island
14.5	Hillock Whins to Nanny Point Scar	**No Active Intervention –** Limited defences present, investigate possibility of withdrawing from maintenance and reinstate natural processes. Establish setback flood defences when flood risk justifies	**Managed Realignment –** Create setback defences to allow open coastline to erode and function naturally	**Managed Realignment –** Create setback defences to allow open coastline to erode and function naturally

14.6	Nanny Point Scar to Mill Scar	**No Active Intervention** – Allow shoreline to continue to evolve under natural processes	**No Active Intervention** – Allow shoreline to continue to evolve under natural processes	**No Active Intervention** – Allow shoreline to continue to evolve under natural processes
14.7	Mill Scar to north of West Shore Park	**Managed Realignment** – continue short term limited intervention at West Shore Park to manage erosion risk whilst coastal adaptation approach is developed. Investigate feasibility of adapting existing coastal defences to improve beach management for the whole frontage while allowing continued movement of sediment along the frontage to maintain the down drift frontages. Develop adaptation approach to move back or relocate the access track, beach access, properties at West Shore Park and golf course assets and undertake as soon as practicable.	**Managed Realignment** – as defences reach the end of their residual lives do not replace them and look to make adaptation/relocation provisions at West Shore Park and the golf course to manage erosion risk.	**Managed Realignment** – By realigning/adapting/rollback of assets at West Shore Park to manage erosion risk
14.8	North Walney from north of West Shore Park to Lenny Hill (both coasts)	**No Active Intervention** – Allow shoreline to continue to evolve under natural processes with monitoring to assess long term risk to landfill site.	**No Active Intervention** – Allow shoreline to continue to evolve under natural processes	**No Active Intervention** – Allow shoreline to continue to evolve under natural processes
Walney Channel				
15.1	Rampside to Westfield Point	**No Active Intervention** – Allow shoreline to continue to evolve under natural processes	**No Active Intervention** – Allow shoreline to continue to evolve under natural processes	**No Active Intervention** – Allow shoreline to continue to evolve under natural processes

15.2	Westfield Point to Hindpool (Barrow-in-Furness)	**Hold the Line –** Manage flood and erosion risk by maintaining existing defences to an adequate standard.	**Hold the Line –** Manage flood and erosion risk by maintaining existing defences to an adequate standard.	**Hold the Line –** Manage flood and erosion risk by maintaining existing defences to an adequate standard.
15.3	Hindpool to Lowsy Point	**No Active Intervention –** Allow shoreline to continue to evolve under natural processes	**No Active Intervention –** Allow shoreline to continue to evolve under natural processes	**No Active Intervention –** Allow shoreline to continue to evolve under natural processes
Duddon Estuary				
16.1	Lowsy Point to Askam Pier	**No Active Intervention –** Allow shoreline to continue to evolve under natural processes	**No Active Intervention –** Allow shoreline to continue to evolve under natural processes	**No Active Intervention –** Allow shoreline to continue to evolve under natural processes
16.2	Askam-in-Furness (including Askam Pier)	**Hold the Line –** Manage flood and erosion risk by maintaining existing defences to an adequate standard.	**Hold the Line –** Manage flood and erosion risk by maintaining existing defences to an adequate standard.	**Hold the Line –** Manage flood and erosion risk by maintaining existing defences to an adequate standard.
16.3	Askam to Dunnerholme	**No Active Intervention –** Allow shoreline to continue to evolve under natural processes	**No Active Intervention –** Allow shoreline to continue to evolve under natural processes	**No Active Intervention –** Allow shoreline to continue to evolve under natural processes

Table 3-3: SMP2 policies for Barrow Borough Coastline

Regional Flood Risk Appraisal, 2008
The Regional Flood Risk Appraisal (RFRA) for the North West Regional Spatial Strategy was produced by 4NW in 2008 and gives a regional overview of flooding from all sources. Given the Government's intention to revoke Regional Spatial Strategies at an early date the RFRA is unlikely to be updated.

South West Lakes Catchment Flood Management Plan, 2009
The South West Lakes Catchment Flood Management Plan (CFMP), gives an overview of flood risk in the South Lakes catchment and sets out the Environment Agency's plans for sustainable flood risk management over the next 50 to 100 years.

For Barrow Borough the CFMP highlights that the main risk of flooding is from sewers with approximately 140 properties estimated to be at risk in a 1 in 100 annual probability event. Aging sewer infrastructure and increased development means that sewer capacity is exceeded in times of high rainfall. Current flood risk management measures include sewer network maintenance and urban storage. The risk of sewer flooding is expected to increase with continued development and due to climate change. The CFMP policy for the area is identified as, "Policy Option 5: areas of moderate to high flood risk where we can generally take further action to reduce flood risk...The current sewer and water infrastructure will be improved so that Barrow can continue to meet the demands of development and regeneration…".

Cumbria County Council Preliminary Flood Risk Assessment, 2011
Preliminary Flood Risk Assessments (PFRAs) are a principal requirement of the Flood Risk Regulations, 2009, which implement the requirements of the European Floods Directive (2007/60/EC). The PFRA gives an overview of all current and anticipated future local sources of flood risk, i.e. surface water, groundwater, ordinary watercourses and artificial sources. It does not cover flooding from main rivers, the sea or large reservoirs, which remain the overall responsibility of the EA. Lead Local Flood Authorities (LLFAs) must review PFRAs every 6 years.

Cumbria County Council, as LLFA, prepared a PFRA in 2011. As part of the PFRA process there is a requirement to report only those past floods which had significant harmful consequences. Defra guidance sets out thresholds for identifying significant harmful consequences as:

- More than 200 people affected, and
- More than one critical service affected.

However, as Cumbria is sparsely populated with only a few urban areas it was felt that a lower threshold should be used for the PFRA to reflect that even in small communities flooding can have locally significant consequences.

The thresholds were thus set as:

- More than 14 people affected (approximately six properties)
- One or more critical service affected.

The PFRA identified that past floods in Barrow were predominantly from sewer flooding, which agrees with the findings of the RFRA as noted above, and that there were no areas with significant harmful consequences of flooding.

Flood Risk Assessment: Barrow-in-Furness, 2006
In August 2006, ABP Marine Environmental Research Ltd. and John Young Associates undertook a Flood Risk Assessment for Barrow-in-Furness, focussed on the areas identified for redevelopment as part of the Barrow Port Master Plan. The study output was a technical report setting out the results of fluvial hydrology and hydraulic modelling and tidal inundation modelling and mapping and concluded that the allocation of land within the Barrow Port Master Plan was generally acceptable, with some marginal risk of flooding to dockside areas.

4. Barrow Study Area

4.1 Location and Overview

The study area for this SFRA is the Barrow Borough administrative area, which is shown in Figure 4.1 below.

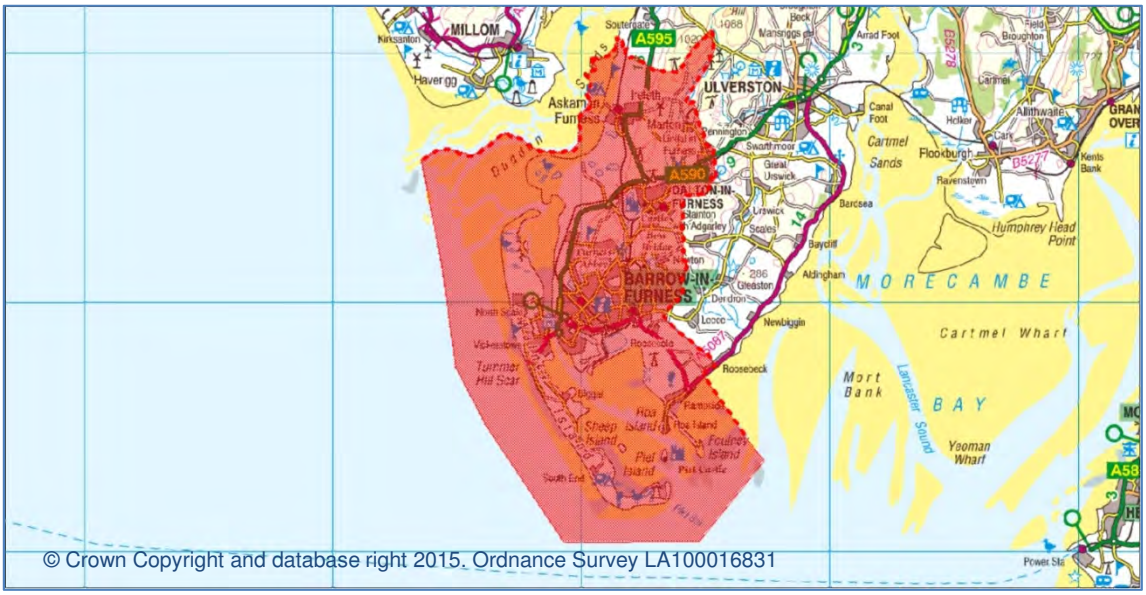


Figure 4.1: Barrow Borough (study area) location plan

Barrow Borough is in the south west of Cumbria and forms part of the Furness Peninsula, between Morecambe Bay to the south and the Duddon Estuary to the north. The Borough covers an area of approximately 30.1 square miles (78 sq. km.). To the north is the Copeland Borough district and to the east and south is the South Lakeland district.

The main urban centres in the Borough are Barrow-in-Furness, Dalton-in-Furness and Askam-in-Furness. The population of the Borough is approximately 70,000, with the majority living in Barrow. Due to its position on the Furness Peninsula, the main route into the Borough is via the A590 Trunk Road from the M6 motorway, which is approximately 26 miles away; from the Borough boundary at Lindal-in-Furness to junction 36 of the M6. The secondary route into the Borough is via the A5087 which leaves the A590 at Ulverston and follows a coastal route into Barrow.

The Borough has a mix of urban and rural areas, with the main centre of employment being the BAE shipyard in Barrow. The majority of the Borough's coastline is designated for its environmental importance, with local, regional and national sites, including Morecambe Bay and the Duddon Estuary.

4.2 General Land Use

Barrow Borough forms the western end of the Furness Peninsula and is bounded by Morecambe Bay to the south and the Duddon Estuary to the north. The main urban areas are Barrow-in-Furness, Dalton-in-Furness and Askam-in-Furness. Barrow is the largest of the three and includes Walney Island. There are a number of smaller settlements, such as Marton, Lindal-in-Furness and Rampside/Roa Island. The remainder of the Borough is rural farmland, mainly used for grazing. There are small areas of woodland such as around Furness Abbey in Barrow.

Within Barrow the main industrial areas are the BAE Systems shipyard and Barrow Port, which are adjacent to Walney Channel and the industrial/retail areas along the A590 Park Road/Walney Road.

Significant infrastructure within the Borough includes the main A roads: the A590(T) which forms the main route from the M6 to the Borough; the A595, which follows a route northwards on the west coast towards Whitehaven; and the A5087 which forms the coastal route from Ulverston to Barrow.

The rail line into the Borough passes through Dalton into Barrow and then travels north through Askam and up the west coast.

Other significant infrastructure includes:

- the BAE Systems shipyard,
- Barrow Port,
- Furness General Hospital,
- 14 GP surgeries and health centres,
- 1 Police Stations, 2 Fire Stations and 1 ambulance station
- 36 primary schools, 4 secondary schools, 1 free school, 2 colleges and 24 pre-schools and nurseries

The Borough also has the following environmental designations:

- Morecambe Bay European Marine Site (EMS), Special Area of Conservation (SAC), Special Protection Area (SPA)
- Piel Flats and Walney Channel Site of Special Scientific Interest (SSSI)
- Duddon Estuary SAC, SPA and SSSI
- 20 County Wildlife Sites
- 8 Regionally Important Geological sites (RIGS)
- 11 Conservation areas
- 270 Listed buildings
- 4 Scheduled Ancient Monuments

4.3 Interaction with Neighbouring Boroughs/Districts

Due to its location at the western end of the Furness Peninsula, Barrow Borough is bounded on its landward sides by South Lakeland District Council. Cumbria County Council is the Lead Local Flood Authority for the area.

The SLDC SFRA was published in 2007 and at the time of writing a revised version has not been published. However, examining the 2007 report there are no areas of high flood risk that overlap the Borough boundary, except for EA Flood Zones in the coastal zone. It should also be noted that the flood risk modelling, for example groundwater and surface water, that has been used in this study overlaps the Borough boundary and thus assessment of grid squares in those areas will take account of flood risk from both within and outwith the Borough. Additionally, the flood modelling for Harlock and Poaka Reservoirs takes account of flooding from outside the BBC boundary.

4.4 Population

The estimated population of the Borough in 2011 was 69,100 according to the Office for National Statistics (ONS), and this is concentrated in the principal settlement of Barrow and the market town of Dalton, with smaller populations in the outlying villages and rural areas.

The population of the Borough is predicted to rise by 2031, although the rate of population increase regionally and nationally is predicted to be significantly higher.

The age profile of the Borough is broadly in line with the national average, although there are fewer people in the age group 20-39. There is a higher proportion of people aged 60 and over compared to the national average and this proportion increased by 3.5% between 2001 and 2011 (ONS). The proportion of older people living in the Borough is projected to increase again up to 2031. Simplistically, this could mean that a greater proportion of the population will be more vulnerable to flood hazards as the population ages.

5. Flooding

5.1 Introduction

Six key sources of flooding are considered in this SFRA:

- From main rivers and ordinary watercourses (fluvial flooding);
- From the sea (tidal flooding);
- From groundwater;
- From surface water;
- From sewers; and
- From artificial sources (reservoirs).

The study area and the locations of main rivers and reservoirs are shown in Figure 5.1.

The following sections present the current understanding of flood risk from each source, identifying where possible the influence on flood risk that any defence or other infrastructure may have. The sections also identify any areas where further assessment may be required when considering flood risk to existing or future development.

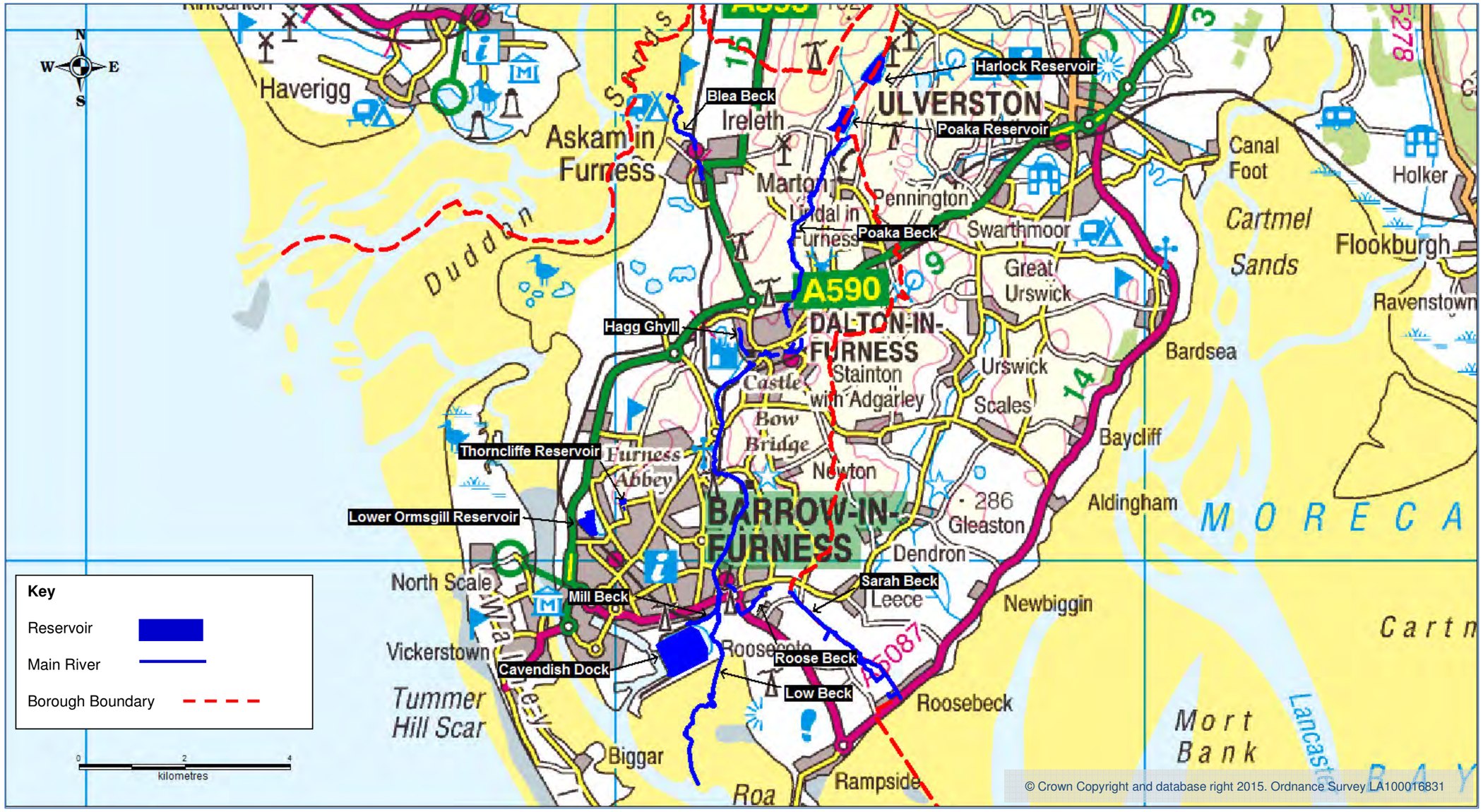


Figure 5.1: Main rivers and reservoirs in Barrow Borough

5.2 Fluvial Flood Risk

Fluvial Flood Risk – Sources
Flooding from rivers and watercourses occurs when water levels rise above the bank levels, or when raised banks (i.e. higher than adjacent land) are breached. The main reasons for water levels rising in rivers are:

- Intense or prolonged rainfall causing runoff rates and flows to increase in rivers, which then exceeds the capacity of the channel. This can be made worse by previously wet conditions leading up to the rainfall event and where there are significant contributions from groundwater;
- Constrictions in the river channel that reduce its capacity and/or cause flood water to backup and spill into the floodplain upstream, i.e. culverts, bridges, etc;
- Blockage of structures or the river channel causing flood water to backup and spill into the flood plain; and
- High water levels and/or locked flood gates preventing discharge at the outlet of a tributary into a river.

The consequences of river flooding depend on how hazardous the flood waters are and the nature of the receptor. Vulnerability varies by land use, for example a children's care home or nursery is considered to be highly vulnerable to flooding, dwelling houses are considered to be more vulnerable and commercial property would be classed as less vulnerable. Further information on vulnerability classifications can be found within the Online Planning Practice Guidance to the NPPF.
The hazard posed by floodwater is proportional to the depth of flooding, the velocity of water flow, the speed of onset of flooding and its duration. Flood hazard can therefore, vary greatly throughout catchments and even across floodplain areas. Hazardous river flows can pose a significant risk to exposed people, property and infrastructure as a result of deep and/or fast-flowing water while lower hazard flooding can be less of a risk to life, by reason of being shallower or with low velocity. It can, however, still disrupt communities, require significant post-flood cleanup and can cause costly and possibly structural damage to property.

Main Rivers
Main rivers are a statutory type of watercourse in England and Wales, and in England all main rivers are so defined by Defra. They are usually larger streams and rivers, but may also include some smaller watercourses. A main river can include any structure or appliance for controlling or regulating the flow of water in, into or out of a main river. The Environment Agency's powers to carry out flood defence works apply to main rivers only.

In Barrow Borough there are seven main rivers:

1. Poaka Beck – from the Borough boundary just south of Poaka Beck Reservoir, through Dalton-in-Furness to its junction with Mill Beck at Millwood.
2. Mill Beck – from its junction with Poaka Beck at Millwood, through Barrow, to its outfall into Cavendish Dock
3. Hagg Gill – from near Cat Crag to its junction with Poaka Beck
4. Roose Beck – from Sedgefield Road to its junction with Sarah Beck
5. Low Beck – from adjacent to Rossefield to its outfall onto Roosecote Sands
6. Sarah Beck – from Roose Beck to its outfall adjacent to the Borough boundary on the A5087 Coast Road

7. Blea Beck – from the back of the A595 north west of Askam Wood to its outfall into the Duddon Estuary near Marsh Grange Farm.

The areas of highest flood risk from main rivers are predominantly where they pass through densely built-up areas. Flooding has occurred from Poaka Beck in Dalton-in-Furness in the area behind Ulverston Road and Market Street adjacent to the cricket ground. Hagg Gill has flooded in the area around Goose Green and Underwood Terrace, also in Dalton. Mill Beck has flooded adjacent to Longway in Barrow. There has also been flooding in the area of Dalton Road and Dale Street in Askam, from Blea Beck.

Ordinary Watercourses
There are a number of smaller watercourses within Barrow Borough which are classified as ordinary watercourses. All watercourses that are not designated as main rivers are termed ordinary watercourses. In Barrow Borough this includes a number of drainage ditches. The regulation of activities on ordinary watercourses is the responsibility of Lead Local Flood Authorities and in Barrow Borough this is Cumbria County Council.

In Barrow Borough there are a number of watercourses, drains and other possible sources of flooding that are inspected by the Borough Council on an annual basis to ensure that they are maintained to reduce flood risk. These are as follows:

1. Park Road headwalls – a minor watercourse passes beneath Park Road in Barrow near the end of Ormsgill Lane to ensure that the culvert is kept clear and to reduce the risk of flooding to Park Road
2. Sandylands Lane – a minor watercourse runs down the side of Sandylands Lane in Barrow and has caused flooding to properties in the past. This is checked to ensure that blockages do not occur that would increase the flood risk
3. Dane Ghyll – a watercourse runs adjacent to Dane Ghyll in Barrow and is inspected to ensure no blockages occur.
4. Abbey Approach – a catchpit is situated in a field adjacent to Abbey Approach in Barrow and if not regularly cleaned flooding can occur down Abbey Approach.
5. Ostley Bank – a watercourse runs adjacent to properties in Ostley Bank, Barrow and into a culvert. The watercourse is inspected to ensure that it flows freely.
6. Andreas Avenue – a watercourse runs through fields adjacent to the bottom end of Andreas Avenue and Shearwater Crescent on Walney Island. The watercourse can become overgrown which increases flood risk to properties in Andreas Avenue.

Fluvial Flood Risk – Flood Zones
Current national planning policy defines three distinct flood zones, 1, 2, and 3, with further sub-classification of Flood Zone 3 into 3a and 3b. Table 5.1 below provides details of how each flood zone is defined. It is important to note that Flood Zones do not consider the presence of flood defences or other flood risk management infrastructure and they do not account for possible climate change impacts. They also do not typically apply to watercourse with a catchment area less than 3km^2 and as such do not include many ordinary watercourses.

Flood Zone	Definition
Flood Zone 1, low probability	Land assessed as having less than 1 in 1000 annual probability of river or sea flooding in any year
Flood Zone 2, medium probability	Land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding in any year
Flood Zone 3a, high probability	Land assessed as having a 1 in 100 or greater probability of river flooding in any year
Flood Zone 3b, functional floodplain	Land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 or greater in any year or is designed to flood in an extreme, 1 in 1000 annual probability, flood

Table 5-1: Fluvial flood zone definitions

Flood Zones are updated on a quarterly basis by the EA, though this will only result in a change to Flood Zones when new data is available, for example from hydraulic modelling, or when existing flood zones have been challenged by a Local Authority or developer. In light of this it is recommended that Barrow BC ensures that its datasets are regularly reviewed to ensure that the latest Flood Zone datasets are available.

This assessment uses the latest EA Flood Zones, which identify zones 2 and 3 and by omission identify those areas that lie within Zone 1. Figures 5.2 and 5.3 present the extent of the EA's Flood Zones 2 and 3 within the study area.

Flood Zone3
Due to its location on the coast the majority of the Flood Zone 3 area within Barrow Borough is along the coastal strip. This is restricted to relatively narrow areas along the mainland coast and wider areas around Walney Island, which is more exposed to direct risk of flooding from the sea during storms.

Fluvial Flood Zone 3 mainly occurs in the catchment of Poaka Beck, with the largest areas of possible flooding lying in Dalton behind Market Street and Ulverston Road, as described above in Section 5.2. A second large area of Flood Zone 3 occurs in Barrow around the Salthouse area and is a combination of flood risk from Mill Beck and tidal flooding from Walney Channel via Ramsden Dock. A third inland area of Flood Zone 3 is around the retail parks along Hindpool Road from Cornmill Sidings across Hindpool Road and into Abbey Road, up to Ramsden Square.

Two areas of Flood Zone 3 are in more rural locations. Firstly, there is an area to the rear of Rampside, and secondly, and area along Sarah Beck adjacent to the Borough boundary and which overlaps into the South Lakeland District Council area at Roosebeck.

Flood Zone 2
Flood Zone 2 results in flood risk in larger areas around Poaka Beck in Dalton and also in the Salthouse are of Barrow. There is a small increase in the area at risk around Hindpool Road in Barrow and further small increase sin area around Sarah Beck and near Rampside.

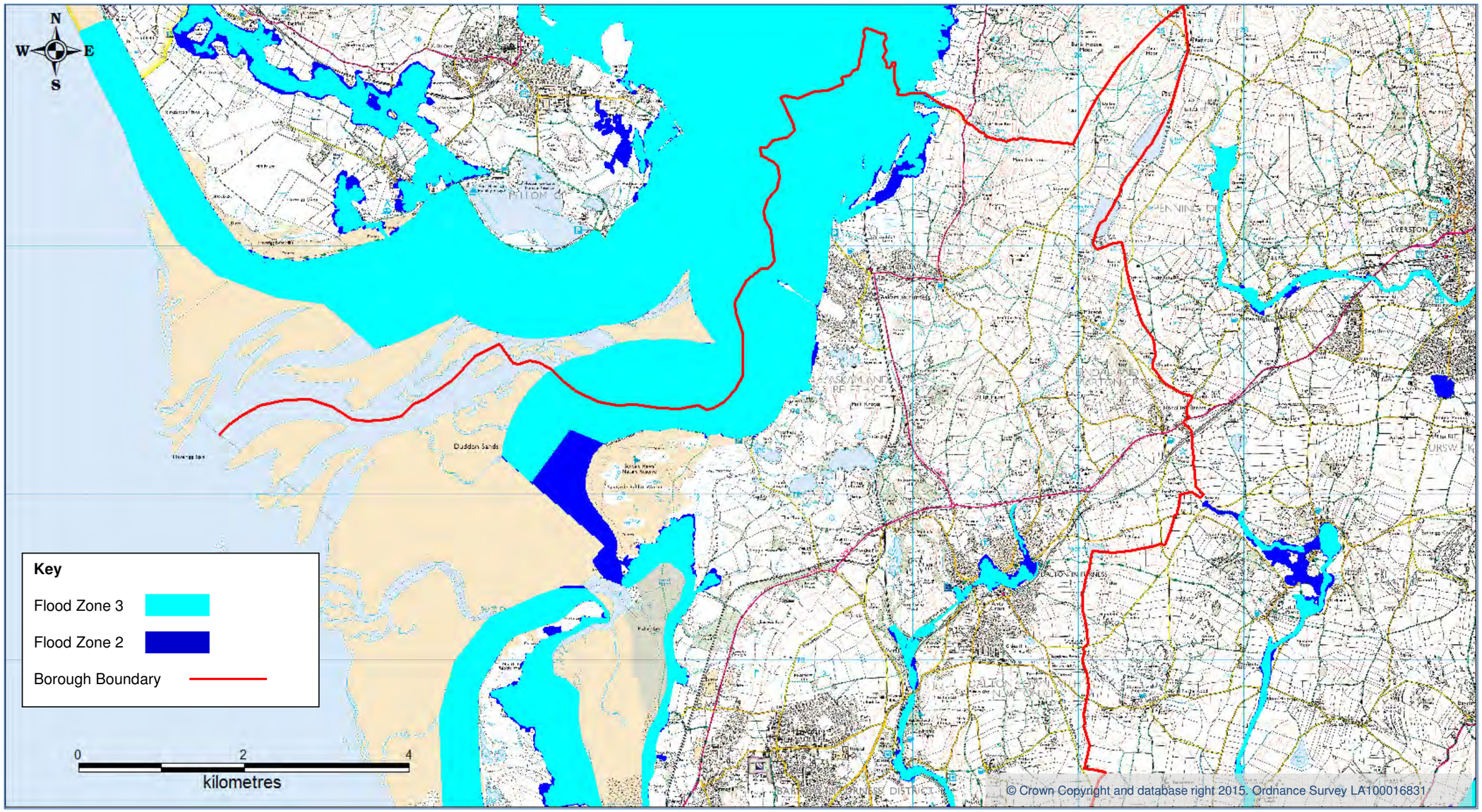


Figure 5.2: EA Flood Zones 2 and 3 - north study area

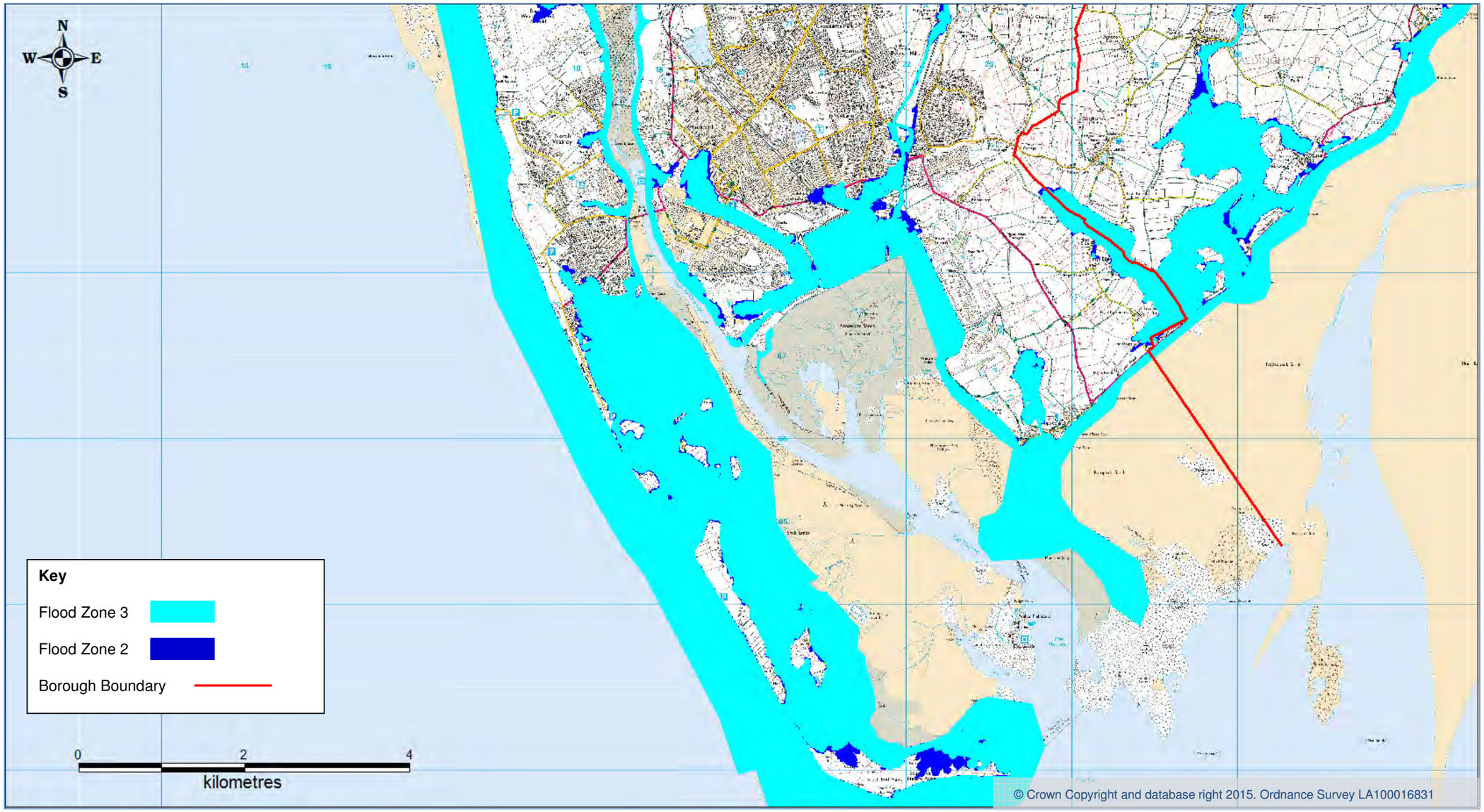


Figure 5.3: EA Flood Zones 2 and 3 – south study area

5.3 Tidal Flooding

Tidal flooding occurs when water levels along the coast exceed the level of coastal land or coastal defences.

Tides are controlled by the gravitational pull of the Sun and moon, by the rotation of the Earth and by the bathymetry of the coast. High astronomical tides occur approximately twice per month when the gravitational pull is at its highest and are at their highest three to four times per year when the moon is at its closest in its cycle.

Astronomical tides can be influenced by storms in which the low pressure results in higher than normal water levels referred to as a storm or tidal surge. When a storm surge coincides with a high astronomical tide the result can be water levels that are significantly higher than usual mean high waters.

Tidal flooding can also occur within rivers and estuaries by 'tide locking', which is where a high tide prevents a river or estuary from discharging into the sea causing 'backing up' and resulting in flooding.

Source of flood risk and overview of defences
The whole coastline of Barrow Borough is exposed to high astronomical tides and storm surges. However not all of the coastline presents a potential source of tidal flooding, due to either high ground levels or the presence of manmade defences. These defences are shown on Figure 5.4

The majority of coastal defences in the Borough are erosion protection; however there are a number of flood defences on Walney Island, as follows:

1. Tummer Marsh – this is an embankment that runs along the side of Ocean Road from Westminster Avenue to Carr Lane and along Carr Lane to opposite Castle View. The embankment is low-lying and flooding occurs to the roads and into the gardens of adjacent properties. There are three drainage outlets that exit either through or adjacent to the structure.
2. Biggar Dyke – this is an embankment built by the monks in the sixteenth century to protect the island around Biggar Village. There has been one recorded breach of the Dyke in 2002 when a section near Biggar Village was washed-out and was overtopped, meeting flood waters from the west of the Island and restricting access for a number of days.
3. Creepshaw Marsh – this is a low-lying embankment adjacent to Mawflat Lane south of Biggar Village. There is a drainage outfall that discharges through the structure.
4. Wylock Marsh – this runs along the eastern edge of Mawflat Lane adjacent to Wylock Marsh
5. South Haws/Shelley Bars – this embankment runs along the access track to the north of the oyster farm at the south end of Walney.
6. Promenade North – this embankment runs along the edge of the Promenade from Jubilee Bridge to North Scale and provides support to the highway. It is overtopped during storms and flooding has occurred to the Ferry Hotel and to properties at the bottom of North Scale. During the storms in December 2013 and January 2014 the road was flooded to a sufficient depth to make it impassable to vehicles.

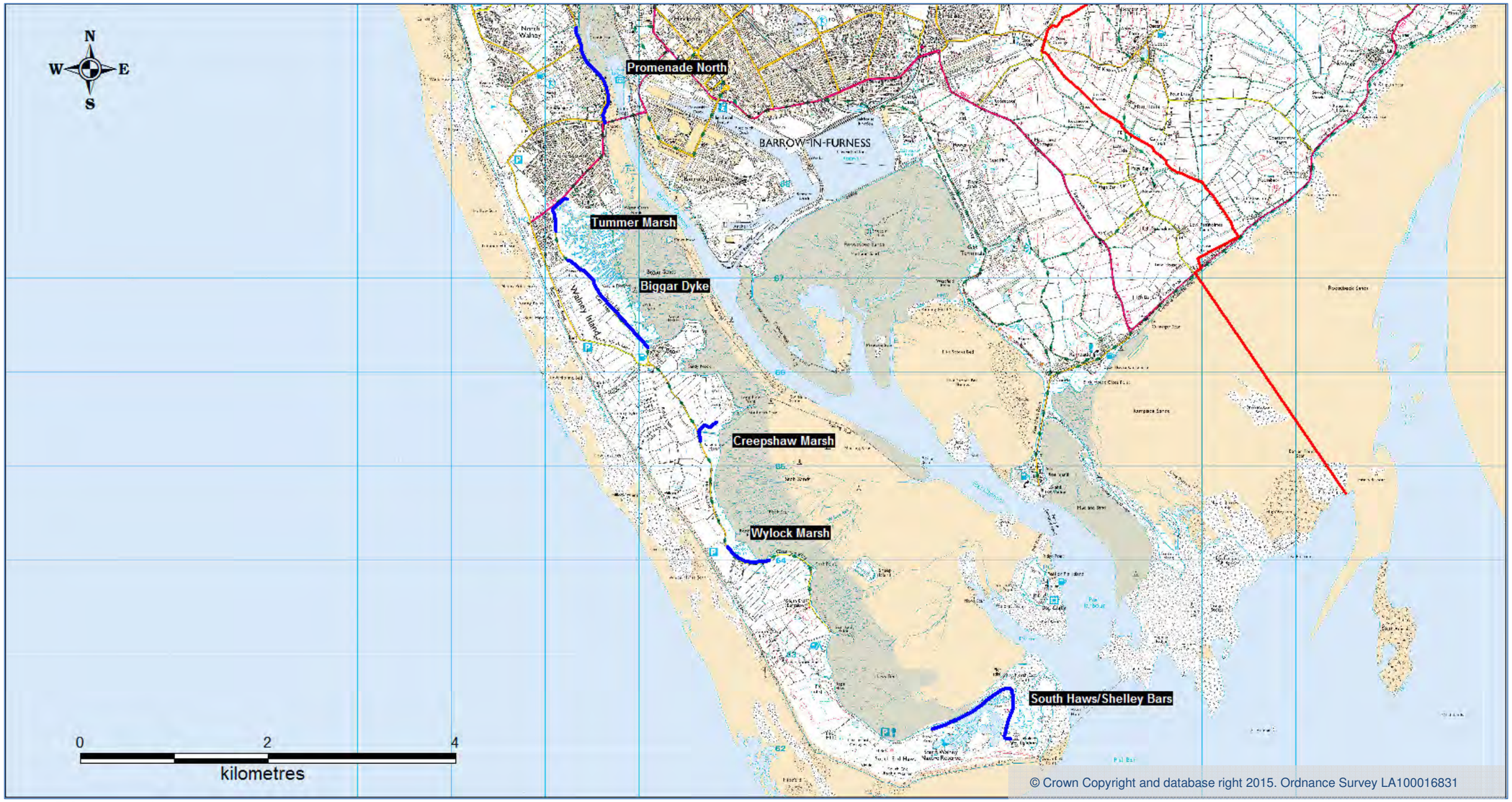


Figure 5.4: Flood defences in study area

Tidal Flood Risk – Flood Zones

Table 5.2 below provides detail of the definitions of tidal flood zones. It is important to note that neither river nor tidal flood zones consider the presence of flood defences or other flood management infrastructure and that they do not account for possible affects of climate change.

Flood Zone	Definition
Flood Zone 1, low probability	Land assessed as having less than 1 in 1000 annual probability of river or sea flooding in any year
Flood Zone 2, medium probability	Land assessed as having between a 1 in 200 and 1 in 1000 annual probability of sea flooding in any year
Flood Zone 3a, high probability	Land assessed as having a 1 in 200 or greater probability of sea flooding in any year
Flood Zone 3b, functional floodplain	Land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 or greater in any year or is designed to flood in an extreme, 1 in 1000 annual probability, flood

Table 5-2: Tidal flood zone definitions

This assessment uses the latest EA Flood Zones which identify Zones 2 and 3 and by omission also identify Zone 1. Figures 5.2 and 5.3 above, present the EA's Tidal Flood Zones 2 and 3 within the study area.

Tidal Flood Risk – Flood Zone 3

The main areas of tidal flood risk are around Walney Island, though the flood mapping does include areas of salt marsh as well as 'land'. To the north of the Island there is an area of flood risk on Walney Airfield, which is owned and run by BAE Systems. To the south of North Scale the Promenade id within Flood Zone 3, with the zone extending into the area near the kennels and also, at the southern end of the Promenade, around the Ferry Hotel and into the park.

Further south there is an extensive area of Flood Zone 3 around Tummer Hill and Carr Lane. This area extends down towards Biggar Village and from Thorney Nook to Hillock Whins, the Flood Zone covers almost the full width of the Island. It should be remembered that the Flood Zone mapping does not take account of defences and flooding to this extent has only occurred in the past when Biggar Dyke was breached in 2002.

At the southern end of the Island the Flood Zone again covers the full width of the Island in the area around South End Caravan Park and during the December 2013 and January 2014 storms flooding to that extent occurred, which cut-off access to the south of the Island for hours until floodwaters had subsided. At the southern tip of the Island the Flood Zone extends across the area around the lighthouse.

On the mainland there is generally a narrow strip of Flood Zone 3 around the coastline with isolated areas where the zone is extends further inland. These areas occur at: Marsh Grange, north of Askam-in-Furness; Lowsy Point; near Sowerby Lodge; the Dock Museum; areas around the Docks; and the entirety of Roa Island and Foulney Island, including the causeway and Foulney embankment. Finally, the A5087 Coast Road is within Flood Zone 3 from near High Banks and past the Borough boundary at Peasholmes Lane.

Tidal Flood Risk – Flood Zone 2
Tidal Flood Zone 2 generally occurs around the edges at the extremes of Flood Zone 3 and there are only a few locations where the extent is significantly greater than Zone 3. The first of these is in the area around the Docks. Including Cavendish Dock and Anchor Basin. There is a second area near Marsh Grange, north of Askam. There is a large area of Flood Zone 2 around Sandscale Haws, though this mainly covers the foreshore and does not extend inland. Walney Airfield is covered by an area of Zone 2 that extends from the east coast into the centre of the airfield. The final areas are on South Walney Nature Reserve around Coastguard Cottages and South End Haws.

Tidal Flood Risk with Defences
As noted above there are only a few formal tidal flood defences in the Borough, all of which lie on Walney Island. Modelling of tidal flood extents has been undertaken as part of the Environment Agency report *Tidal Areas Benefitting from Defence,* 2007 and an interactive GeoPDF has been developed to display the results for Barrow. The GeoPDF allows the user to specify the storm conditions by choosing from a range of still water levels and wind speed and direction. The map can then show whether the chosen conditions will cause flooding and if so, the number of properties at risk, along with flood extents, depths and hazard ratings. An example of the GeoPDF output is included in Appendix C and the GeoPDF is included with the electronic version of this report.

Utilising the GeoPDF a number of conclusions can be reached from the model results:

- For still water levels up to and including 6.25m Above Ordnance Datum (AOD) flooding is dependent on wind direction and speed and therefore, flooding mainly occurs due to wave action overtopping the coastline and any defences present
- For still water levels of 6.5mAOD and wind direction between 210° and 315° for wind speeds of Force 2, 32 properties are at risk of flooding from water depths of up to 1m. Increasing the wind speed to Force 4 increases the number of properties at risk to 233, with depths of up to 1m to 2m.
- For still water levels above 6.5mAOD, i.e. 7.0mAOD and 7.5mAOD, the maximum number of properties at risk is 237 for all angles of wind direction at Force 2 and above wind speed.

5.4 Surface Water and Sewer Flooding

Flooding form the land can be caused by rainfall being unable to infiltrate into the natural ground or unable to enter watercourses, due to blockage, or if flows within the drainage system are already at or above capacity. This can then result in temporary localised ponding and flooding. The natural topography and location of buildings and structures can influence the direction and depth of water flowing off impermeable and permeable surfaces.

High intensity storms, often with short duration, are sometimes unable to percolate into the ground, be drained by formal drainage systems when the capacity of these collection systems is not sufficient to convey runoff to underground pipe systems, which themselves may be surcharged. The pathway for surface water flooding can include blockage and overflows of the drainage system and failure of sluice outfalls and pumping systems.

Flooding can also result when the design capacity of sewers, typically combined foul and surface water, is exceeded and water surcharges into the surrounding environment. Because of

the links to rainfall, some aspects of surface water flooding are sometimes referred to as pluvial flooding.

There are datasets available from the Environment Agency that identify the extent of surface water flooding within the Borough. In 2009 EA published its Areas Susceptible to Surface Water Flooding (AStSWF) map, which shows those areas with a Low, Intermediate or High susceptibility to flooding from a 1 in 200 annual probability storm event. Towards the end of 2010 the EA released a second dataset, the Flood Map for Surface Water (FMfSW), which presented surface water flooding from 1 in 30 and 1 in 200 annual probability storm events. These outputs considered different critical storm durations and took into account losses from different types of land uses.

Figures 5.5 and 5.6 show the various surface water flood risk areas.

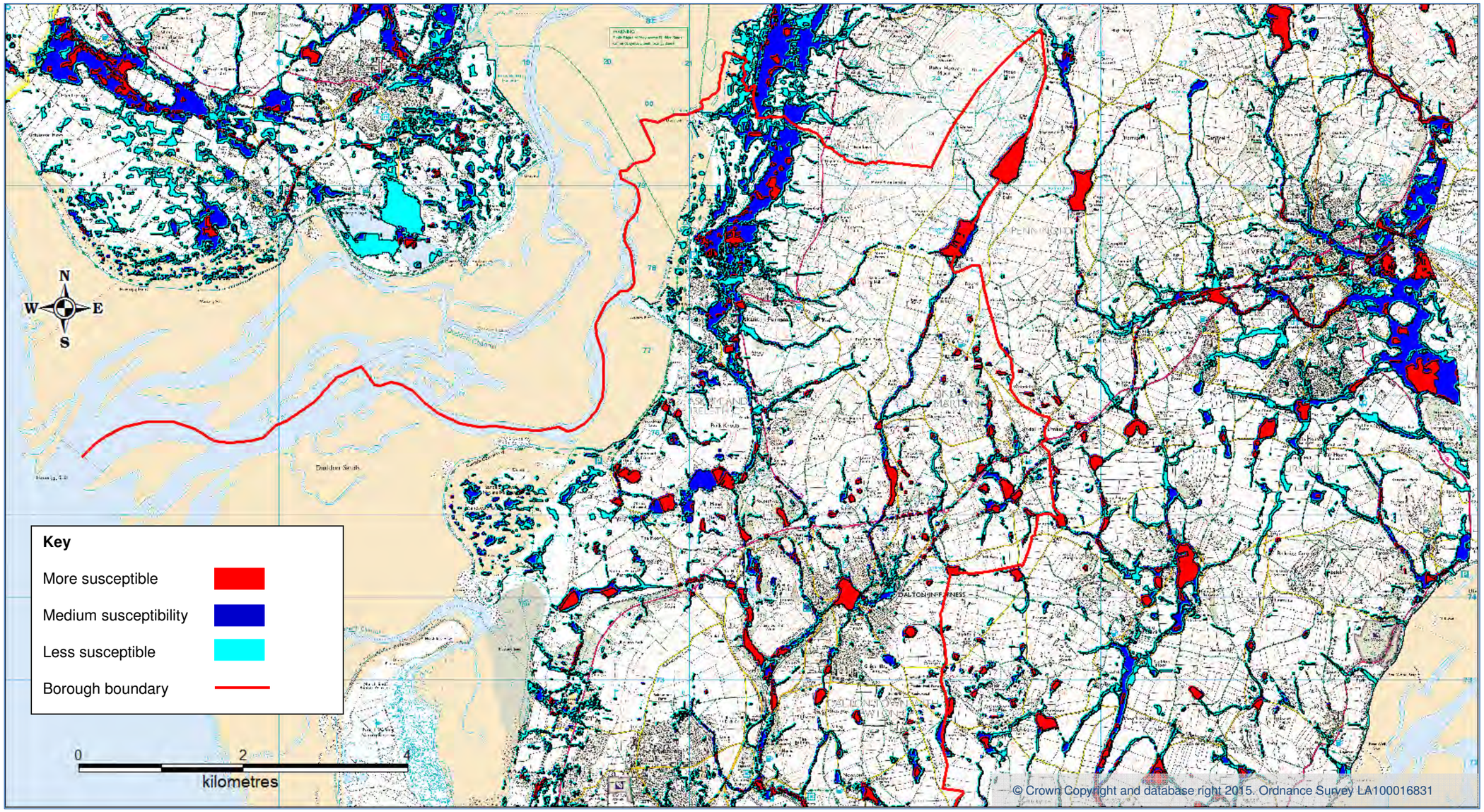


Figure 5.5: Surface water flood risk areas - north study area

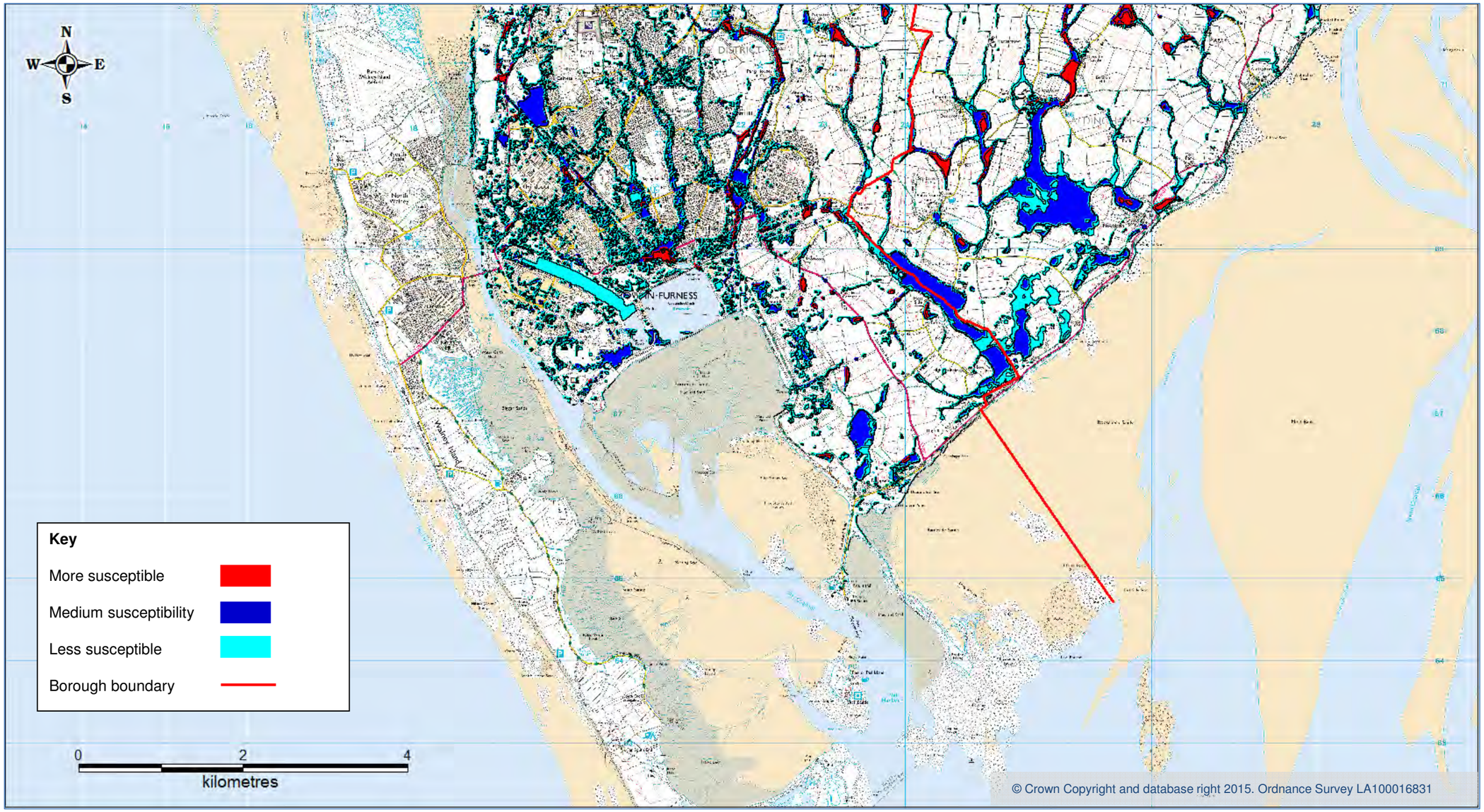


Figure 5.6: Surface water flood risk areas - south study area

Areas Susceptible to Surface Water Flooding (AStSWF)
The AStSWF dataset shows areas where surface water would be expected to flow or pond. The modelled and mapped areas are based on a 1 in 200 annual probability storm event. Three outputs are provided:

- Less Susceptible – flooding greater than 0.1m and less than 0.3m deep
- Medium Susceptibility – flooding between 0.3m and 1.0m deep
- More Susceptible – flooding greater than 1.0m deep.

The 0.1m threshold for Less Susceptible was chosen to remove modelling 'noise' that may suggest flooding where there really is none. The 0.3m threshold was chosen as it represents a typical value for the onset of significant property damages when property flooding may start (i.e. above doorstep level) and because it is around this depth that moving through floodwater (both walking and driving) may become difficult. Both of these may lead users to consider the need to close roads or evacuate areas.

The following presents a brief discussion of the Medium Susceptibility and More Susceptible areas from the AStSWF datasets:

- Askam and Ireleth area – Much of the open land from near the Borough boundary at Marsh Grange to the northern fringe of the built-up areas of Askam and Ireleth is an area of Medium Susceptibility with smaller areas of More Susceptible. Within Ireleth there are narrow bands of Medium Susceptibility near Ireleth Brow and Saves Lane. In Askam there is a large area of Medium Susceptibility that stretches from the eastern side of Dalton Road (A595), across into Duddon Road and along Duke Street, westward towards Fallowfield Park and the Lifeboat Station. This area then stretches south to Lots Road, past the school, then along the railway line to the brick factory. Within this larger area of Medium Susceptibility there are a number of small More Susceptible areas near Dale Street, Duke Street and Beach Street.
- Dalton-in-Furness – There is a narrow corridor of Medium Susceptibility area along Poaka Beck along the back of Butts Beck to the Fire Station and southwards along King Street and Prince Street to Ulverston Road. A second area of Medium Susceptibility stretches from between The Yarl and Poaka Beck across the cricket and football grounds and across Station Road, Beckside Road and Romney Road. This meets a large area of More Susceptible, which stretches from Romney Road north across Market Street to Chapel Street between the back of Fell Croft and west of Wellington Street. A third area of Medium Susceptibility is to the west of Newton Road from Barnes Avenue to opposite the end of Stainton Drive. A small area of More Susceptible is included in the southern end of this area.
- Marton and Lindal-in-Furness – there are a few small areas of Medium Susceptibility and More Susceptible in Marton and Lindal, with the main area being to the west of The Green in Lindal.
- Newton-in-Furness and Stank – there is an area of Medium Susceptibility and a smaller area of More Susceptibility in Newton around to southern side of Newton Cross Road near the village hall. In Stank there is an area of Medium Susceptibility that runs through the village along Stank Lane.
- Rampside and Roosecote – there are a number of small areas of Medium Susceptibility in Rampside and one small area of More Susceptible to the north of Hall Garth. There are also small area of Medium Susceptibility within the boundaries of the Gas Terminals and Power Station at Roosecote.
- Barrow-in-Furness – in Barrow there are numerous small areas of Medium Susceptibility. Larger areas tend to be along corridors, such as: around Dane Ghyll Beck; along Rating Lane and Flass Lane southwards to Boradway; along Hollow Lane

and Lesh Lane through Newbarns and into Abbotsmead; from Barrow Park through Devon Street into the Salthouse area; along the railway line near Holker Street through parts of Rawlinson Street, Sutherland Street southwards to around Smeaton Street; along the Strand from Michaelson Road to Albert Street; Abbey Road around Ramsden Square; and, North Road around the Tesco superstore and the Dock Museum. The main areas of More Susceptible are: in Furness Abbey grounds; a small area off Rating Lane near Holyoake Avenue; along Mill Beck from Flass Lane to Gateway; a small area between North Row and South Row and an area behind Stonedyke Lane; a larger area around Salthouse Road from Vulcan Road to Risedale Road; a number of small areas along the western side of the industrial areas off Park Road; an area at the north eastern side of Holker Street near the railway station; and, a small area on North Road near the Tesco superstore.

Surface Water and Sewer Flooding – Historic Records
In June 2001 the Cumbria County Council Preliminary Flood Risk Report was published. This report was prepared to help manage flood risk in Cumbria and to deliver the requirements of the Flood Risk Regulations 2009. The Preliminary Flood Risk Assessment (PFRA) is aimed at providing a high level overview of flooding from local flood sources, including surface water, groundwater, ordinary watercourses and canals.

As part of the study methodology it gathered data on historic flooding incidents from local authority records and the United Utility (UU) Sewer Incident Record System. In total 500 incidents were recorded throughout Cumbria. The PFRA assessed these historic flooding incidents to identify those that had significant harmful consequences. This is defined in the PFRA guidance as incidents where more than 200 people were affected and/or more than one critical service was affected. However, due to the sparsely populated nature of most of Cumbria the PFRA set a lower threshold for the flood risk to be considered significant as:

- More than 14 people affected
- One or more critical services affected

14 people equates to roughly more than six properties.

For the Barrow Borough area there were three flooding incidents identified that were considered or known to have had significant harmful consequences. These were one each in Barrow, Askam and Dalton and were all identified from UU records. However, once the flood risk thresholds were applied to these incidents it was found that none were classified as locally significant historic events.

5.5 Groundwater Flooding

Groundwater flooding occurs when water levels in the ground rise above the surface. It is most likely to occur in low-lying areas underlain by permeable drift and rocks.

Where groundwater flooding occurs, it may have a number of different aspects. In low-lying depressions groundwater can be above the ground surface and cause ponding that can last for long periods of time. Elsewhere it may result in watercourses flowing where there are normally nonem and in other areas it may cause waterlogging of ground. It is difficult to predict how groundwater flooding will affect an area. However, groundwater will typically emerge and flow to low points where it will pond or form ‘new’ watercourses. Consequently, existing surface water

flooding datasets may in some locations be a suitable proxy for the areas that might be affected within those areas at risk from groundwater flooding.

The Environments Agency's national dataset, Areas Susceptible to Groundwater Flooding (AStGWF), was used to inform the assessment of future flood risk from groundwater. This dataset is modelled on a 1km square grid and applies a rating to each square of the susceptibility to groundwater flooding in bands of less than 25% (<25%), 25% to 50%, 50% to 75% and greater than 75% (>75%). Within the Borough there are 10 grid squares in the 25% to 50% category, 4 grid squares in the 50% to 75% category and 2 grid squares in the >75% category, with the remaining area in the <25% category. The areas at risk from groundwater flooding are shown in Figure 5.7.

The higher susceptibility locations of the grid squares in the 50% to 75% and >75% categories are briefly described below:

- 50% to 75% - around Marsh Grange and Tippin's Bridge, north of Askam and Ireleth (the grid square overlaps the Borough boundary)
- 50% to 75% - in Barrow, from Ormsgill Reservoir southwards towards Blake Street and from Barrow Cemetery westwards to Phoenix Road near Barrow Fire Station
- 50% to 75% - on Walney Island from Mill Lane to Cows Tarn Lane
- 50% to 75% - in Barrow covering Yarlside, south of Larch Rise, and Roose towards Dungeon Lane
- >75% - in Barrow, covering Ormsgill north of Ormsgill Reservoir towards Mill Bank and from Quarry Brow westwards to the railway line
- >75% - in Barrow covering Hindpool and the Town Centre from Blake Street southwards to Schneider Square and from Dalton Road and Rawlinson Street westwards to west of Ironworks Road.

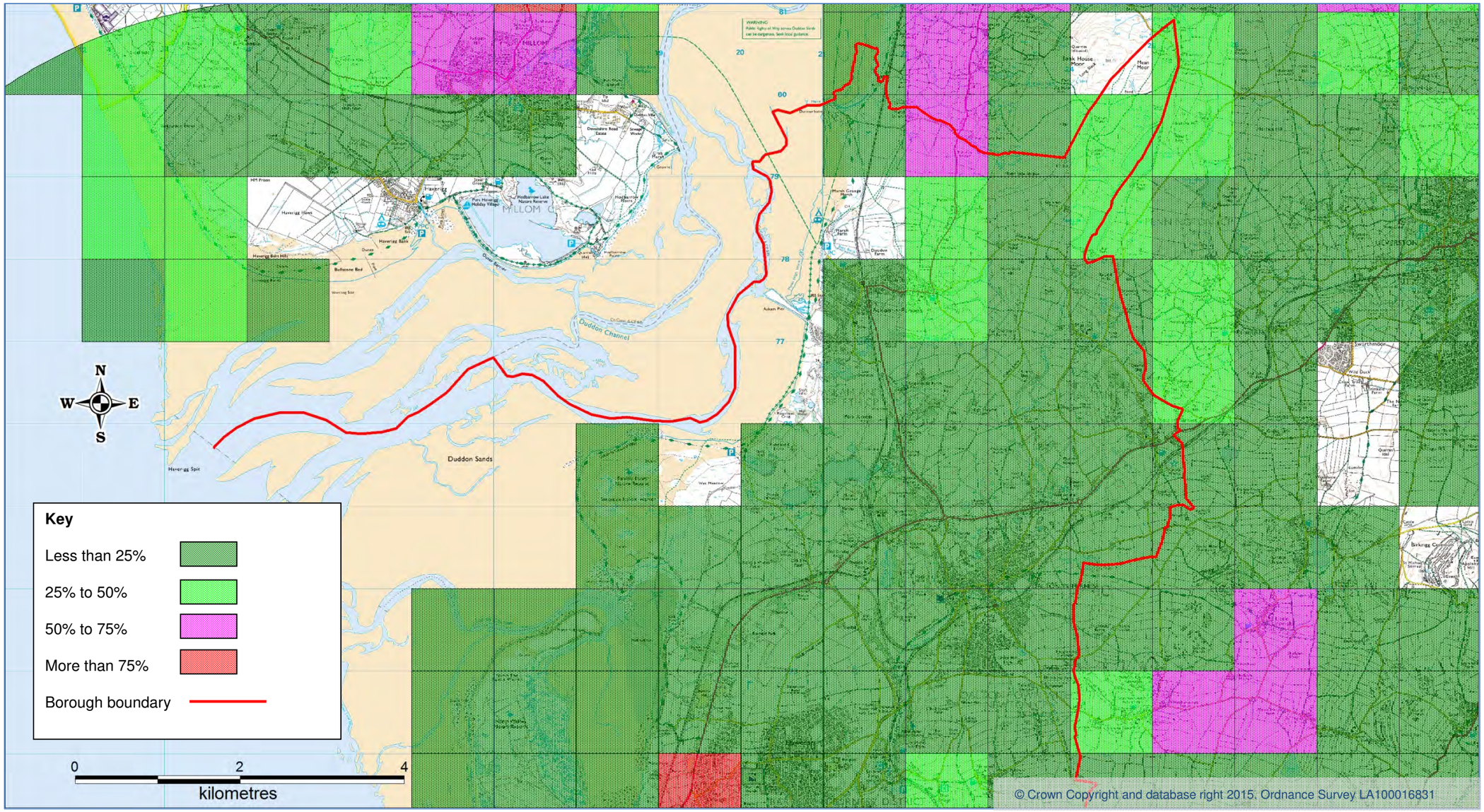


Figure 5.7: Groundwater flood risk - north study area

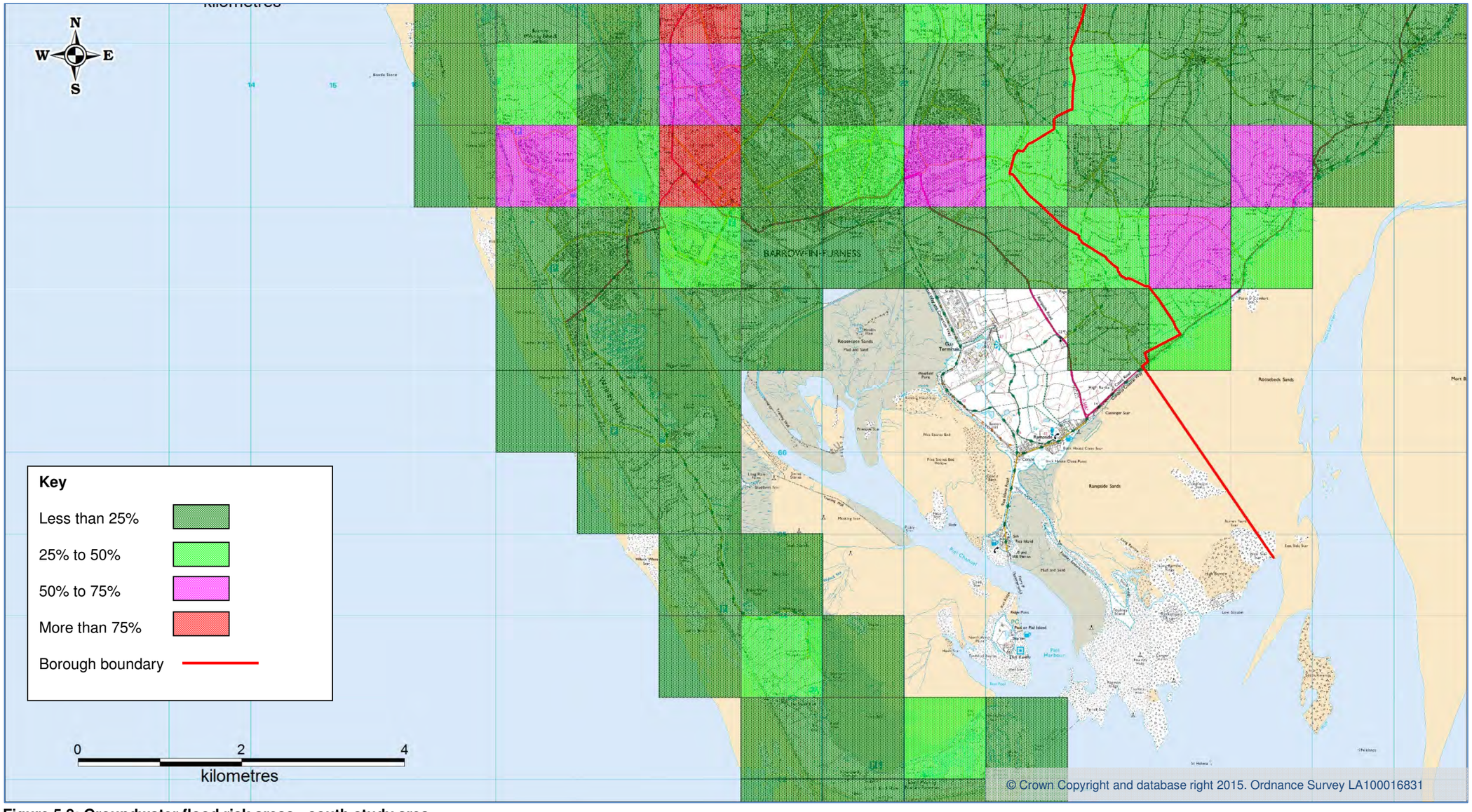


Figure 5.8: Groundwater flood risk areas - south study area

5.6 Flooding From Artificial Sources

Reservoirs
There are four reservoirs within the Borough that could pose a risk of flooding: Lower Ormsgill, Cavendish Dock, Poaka Beck and Thorncliffe. Additionally, Harlock Reservoir, although it is outside of the Borough has also been considered as it has the potential to cause flooding within the Borough and due to its close proximity to Poaka Reservoir. Locations of reservoirs are shown on Figure 5.1 above.

The Environment Agency is the enforcement authority for the Reservoir Act, 1975 in England and Wales. The EA ensures that reservoirs are regularly inspected and essential safety work is carried out. Barrow BC is responsible for Lower Ormsgill Reservoir and for emergency planning for reservoir flooding to ensure that communities are prepared in the event of reservoir flooding.

The Reservoirs Act 1975 is in the process of being updated by the Flood and Water Management Act 2010. This Act reflects a more risk-based approach to reservoir regulation through:

- Reducing the capacity at which a reservoir will be regulated from 25,000m^3 to 10,000m^3 (this proposal has currently (April 2015) been indefinitely postponed and thus the default remains at 25,000m^3, if this situation changes the SFRA will be updated accordingly);
- Ensuring that only those reservoirs assessed as high risk are subject to regulation;
- Ensuring that all undertakers with reservoirs over 10,000m^3 register their reservoirs with the EA;
- Inspecting engineers must provide a report on their inspection within six months;
- All undertakers must produce a reservoir flood plan; and
- All incidents t reservoirs must be reported.

Reservoir owners are also required to produce on-site emergency plans. These detail what response will be made to a potential or actual reservoir failure.

In 2009 the EA produced a series of reservoir inundation maps. Only large reservoirs that hold over 25,000 cubic metres of water were assessed. Maps of the maximum flood extent are available on the EA website and are shown in Figures 5.9 to 5.12. Details of flood depths and velocities were also modelled, but due to National security reasons these are restricted and not available publicly.

Cavendish Dock is owned and maintained by Associated British Ports. If the reservoir wall were to be beached flood waters would mainly affect the adjacent docks, a small area to the rear of Salthouse Road, the area around Salthouse Mills, the sewage works and part of Roosecote Power Station.

Lower Ormsgill Reservoir is owned and maintained by Barrow Borough Council. The reservoir has two raised embankments; along Devonshire Road and adjacent to the railway line. If these were to breach flood waters would affect the area immediately to the west of the reservoir, including the railway line, the A590 and Barrow Fire Station. Further flooding would occur to the housing estate known as the Griffin and follow the railway line south eastwards towards Abbey Road and Holker Street, continuing further south eastwards along a corridor stretching from the railway line towards Rawlinson Street into the Salthouse area. Flooding would also occur along

Abbey Road south westwards towards Cornerhouse Park and into Walney Channel around the area of the Dock Museum.
Thorncliffe Reservoir is a covered reservoir and is owned and maintained by United Utilities. Flood waters from the reservoir would flow in two initial directions: south westwards through Barrow Cemetery towards Lower Ormsgil Reservoir after which it would follow the same flow path as flood waters from Lower Ormsgill; and south eastwards through the former Thorncliffe school grounds, across Oxford Street and down Hollow Lane into Newbarns. Flooding to the south eastwards would also flow down Oxford Street across to Abbey Road to join the flood waters from the south westward side as well as flowing through Barrow Park towards Greengate School and through Risedale towards Salthouse.

Harlock and Poaka Reservoirs are owned and maintained by United Utilities. Flooding from a breach of Harlock Reservoir would flow into Poaka Reservoir and if this were to be subsequenlt breached or overtop its banks flood waters would floe mainly along a narrow corridor either side of Poaka Beck until reaching Dalton-in-Furness where flooding would be more extensive. Flooding in Dalton would affect a large area stretching from the north around Maidenlands southwards towards Market Street and the football and cricket grounds, and then westwards towards Weint Corner. Further flooding would occur north of Market Street towards Dowdales school. South of Dalton flooding would again largely follow the path of Poaka Beck through Abbotswood, past Furness Abbey and Parkhouse Farm towards Yarlside and Old Roose. From there flooding would spread westwards towards Salthouse.

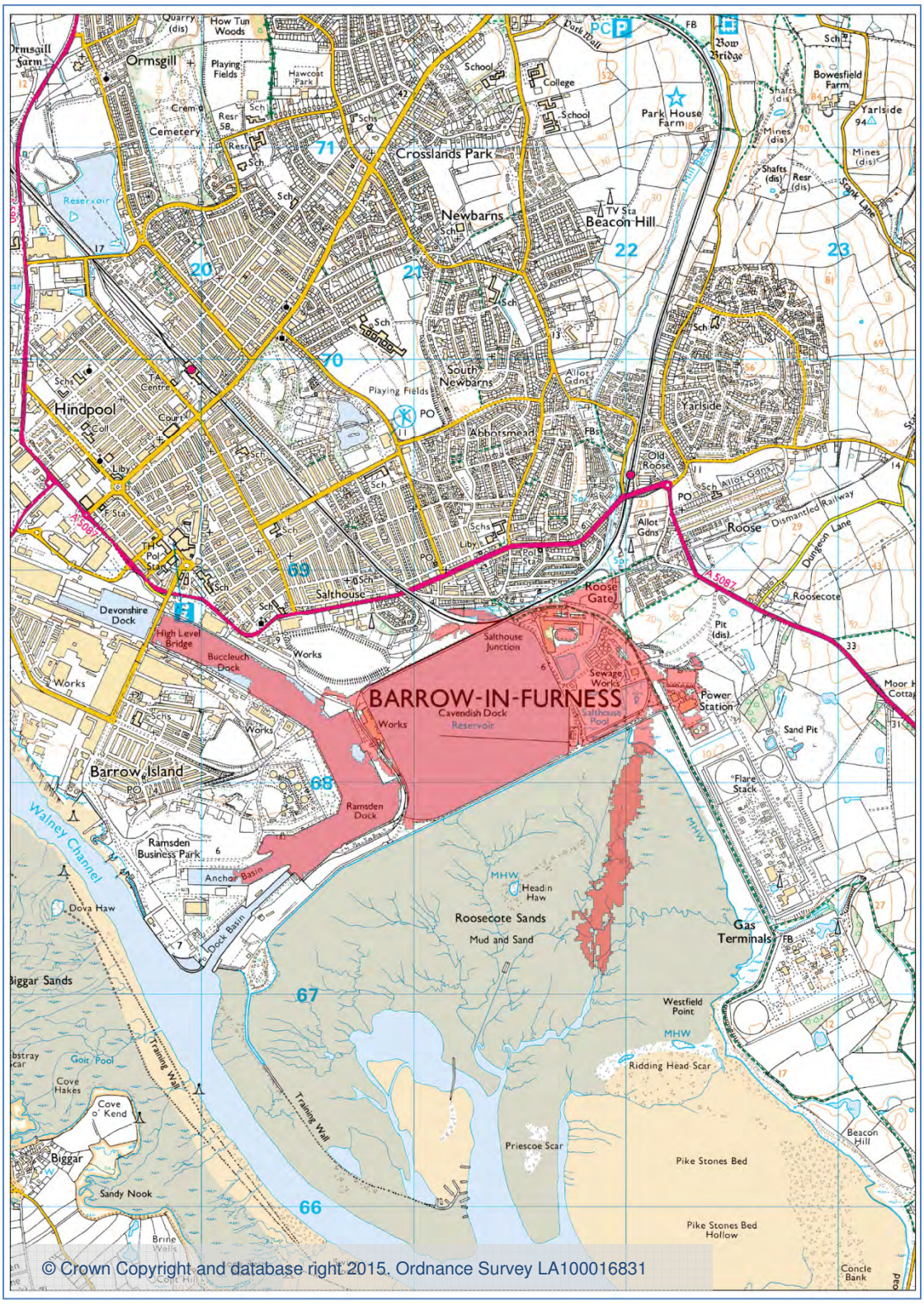


Figure 5.9: Cavendish Dock Reservoir inundation map

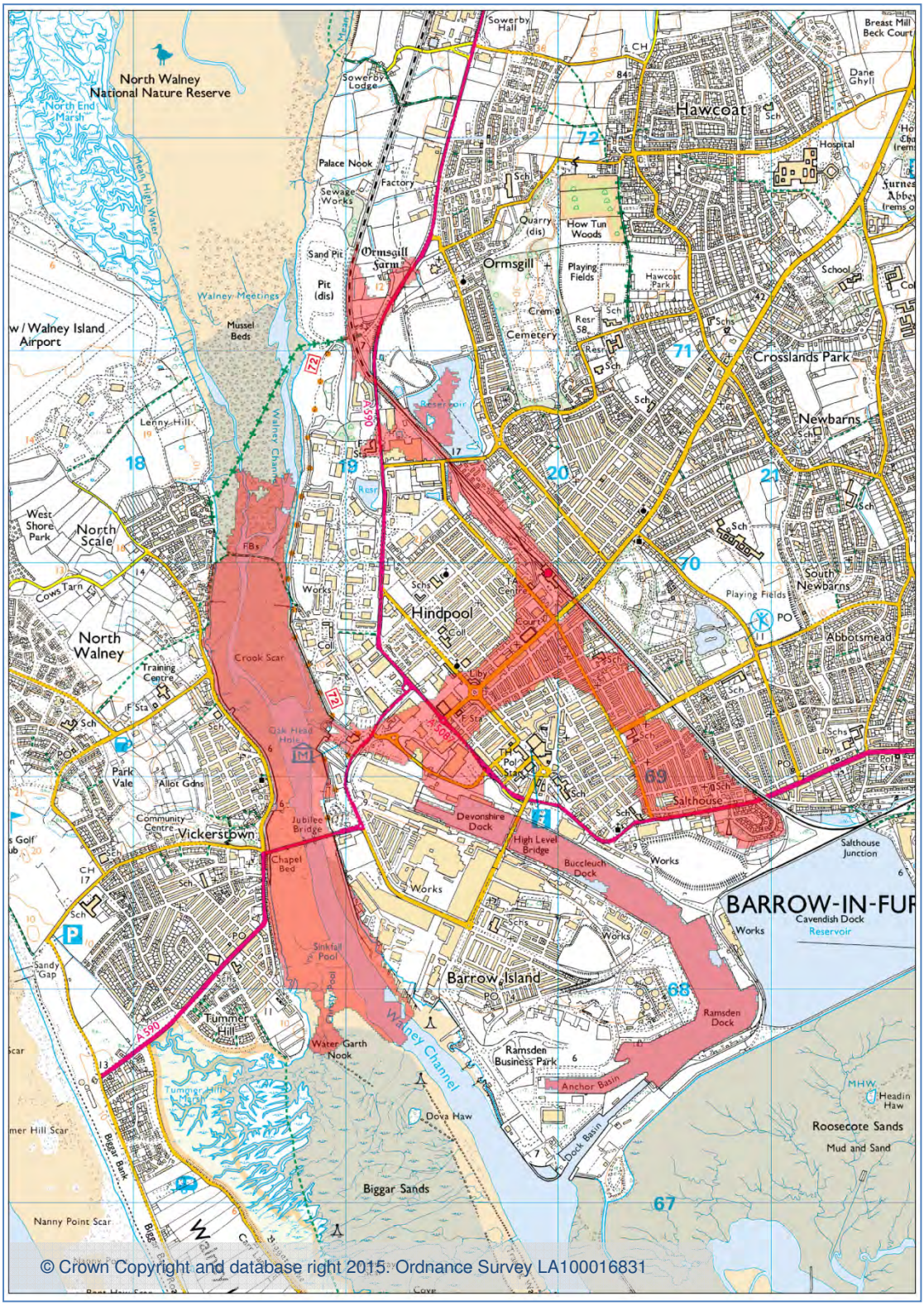


Figure 5.10: Lower Ormsgill Reservoir inundation map

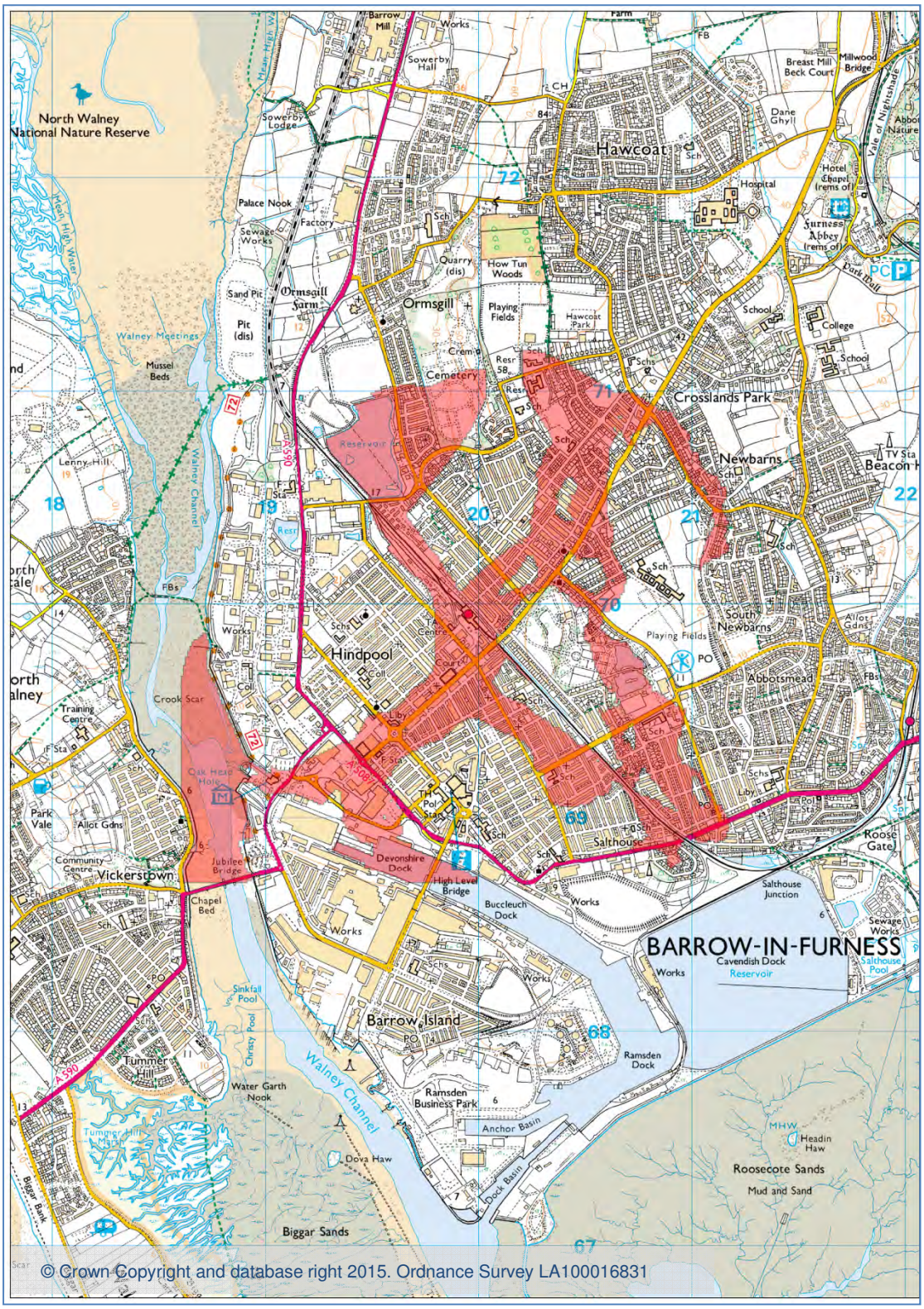


Figure 5.11: Thorncliffe Reservoir inundation map

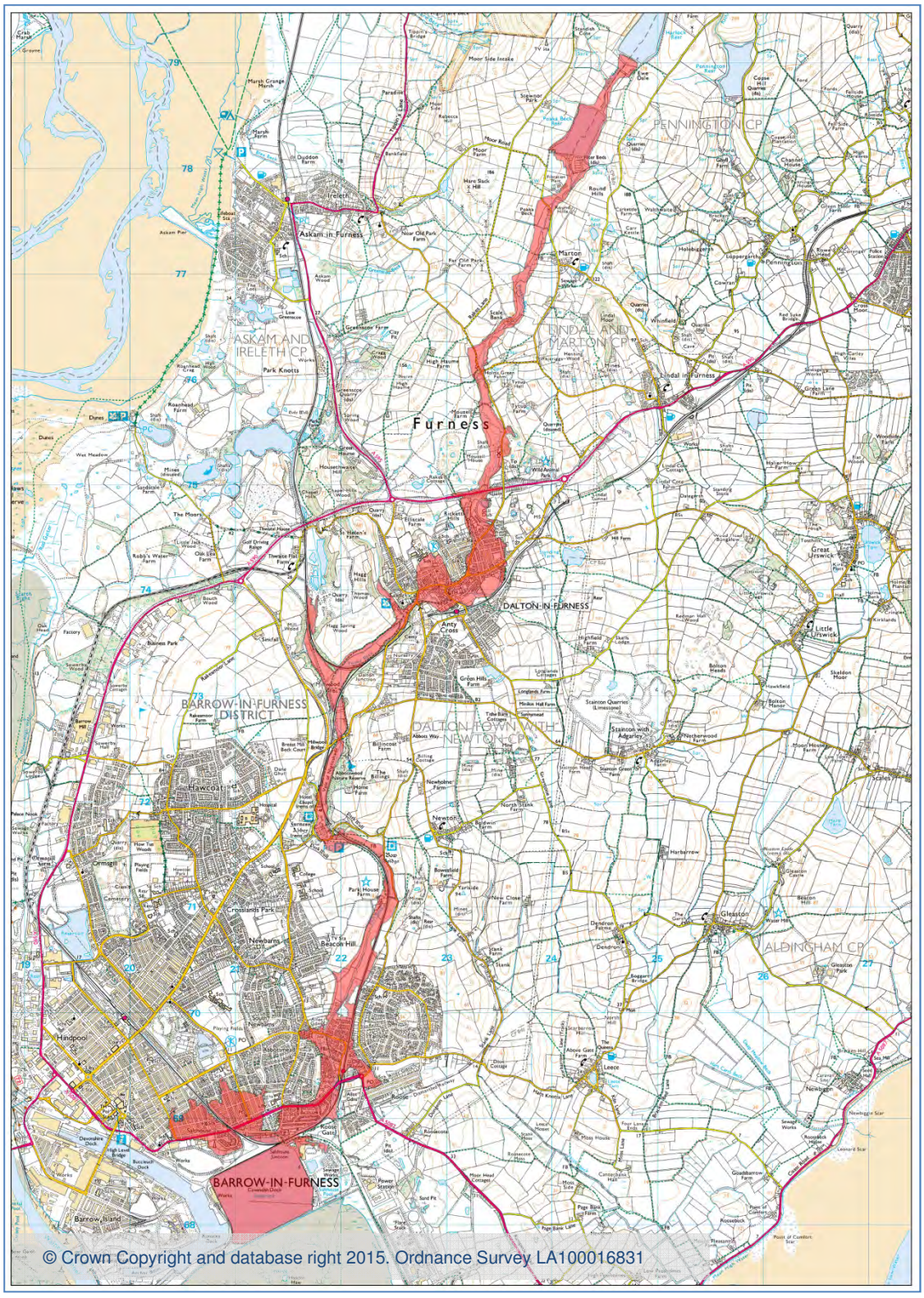


Figure 5.12: Harlock and Poaka Reservoirs inundation map

6. Summary of Flood Risk

6.1 Principal Sources of Flood Risk

The principal source of flood risk within Barrow Borough, based on the spatial extent of the dataset, is surface water flooding, as this presents a risk across most of the Borough. However, there are flood risks from all sources somewhere within the Borough.

Fluvial (river) flood risk is notable mainly along two main river corridors. The first is along Poaka Beck through Dalton and into Barrow where it joins Mill Beck and flows onwards to Cavendish Dock. The second is along Blea Back in Askam.

Tidal flooding is the main risk around Walney Island and can cause flooding on both sides of the Island. Areas of the mainland, such as at Rampside and Roa Island can also be subject to tidal flood risks. However, there are only limited numbers of properties that are currently at risk of tidal flooding.

Surface water flood risks affect a significant proportion of the Borough, although the dataset does not cover Walney Island, so it is not possible to assess surface water flood risks there. There are areas of Medium Susceptibility and More Susceptible in the main towns of Barrow, Dalton and Askam/Ireleth and also in a number of the villages.

Sewer flooding has been an issue on the past, though the main risk areas have been improved by recent works to improve sewer capacity, mainly within Barrow town centre.

Groundwater flood risks are considered to be relatively low, though there is potential for flooding identified fromt he dataset in Askam/Ireleth, Barrow and Walney Island.

Areas of Barrow and Dalton are also at risk from failure of reservoir embankments. Failure of Cavendish Dock would affect areas around Roose Gate. Failure of Ormsgill Reservoir would affect areas immediately adjacent to the reservoir and flooding would extend along the railway line through the town centre and into the Salthouse area. For the Thorncliffe Reservoir flooding would affect an area from the Cemetery to Abbey Road, Barrow Park, the Town Centre and again on to Salthouse, Failure of Poaka and Harlock would cause flooding along the Poaka Beck/Mill Beck corridor and again would lead to the Salthouse area. A combination of the failures would obviously greatly increase flood risk to the Salthouse area.

The combination of flood risk from different sources creates areas where flood risk is high and these can be considered as ‘hotspots’, which should be noted when considering future development. These flood risk hotspots are:

- North of Askam and Ireleth around Marsh Grange – mainly tidal with some surface water risk
- The east coast of Walney Island along the Promenade form North Scale to Jubilee Bridge – mainly tidal with records of historic flooding
- Barrow around Hindpool Road, North Road and Abbey Road – a combination of tidal surface water and groundwater flood risks
- Rampside, Barrow – tidal and surface water
- Central Dalton along the Poka Beck corridor in to Barrow along Mill Beck and into Salthouse – tidal, fluvial, surface water and groundwater flood risks.

7. How to Use the SFRA in Local Planning

7.1 Introduction

National guidance on development and flood risk requires that the allocation of sites for development takes into account the nature and spatial distribution of flood risk, as well as the degree of vulnerability of different types of development. This should be achieved at all stages of the development planning process, including the allocation of sites in the Local Plan and when assessing windfall planning applications. The guidance advocates a sequential risk-based approach to the allocation of sites and to development within sites. The evidence in this SFRA is also intended to inform developers when they prepare site-specific flood risk assessments.

In summary the SFRA provides the evidence to:

- Direct development away from areas at greatest risk of flooding and manage residual risk, taking into account the possible impacts of climate change – applying the risk-based Sequential Test approach to choice of sites in the Local Plan, and where necessary applying the Exception test;
- Inform the Sustainability Appraisal of the Local Plan;
- Make sure that any development is safe, does not increase flood risk (from any source) elsewhere, and if possible reduces flood risk overall; and
- Inform the preparation and content of site-specific flood risk assessments for development sites, and help identify when site-specific flood risk assessments or flood risk management statements are required.

This chapter focuses on all four of these bullet points, in relation to Local Planning. In the next chapter the last two bullet points are discussed in relation to develop management.

Further detail on the Sequential Test and the Exception Test are set out below.

7.2 Sequential Test

The aim of the Sequential Test is to steer development to the areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. The EA Flood Zones are the starting point for assessing the probability of flooding in the Sequential Test approach. Details of the Flood Zone definitions are set out in Table 7.1 below.

SFRAs should refine the information from the Flood Zones using data available on other sources of flooding and the possible impacts of climate change and will form the basis of applying the Sequential Test and the Exception test. This SFRA takes into account the data available on all sources of flooding, the presence and effects of flood defences and other flood management infrastructure and provides an assessment of flood risk within the Borough.

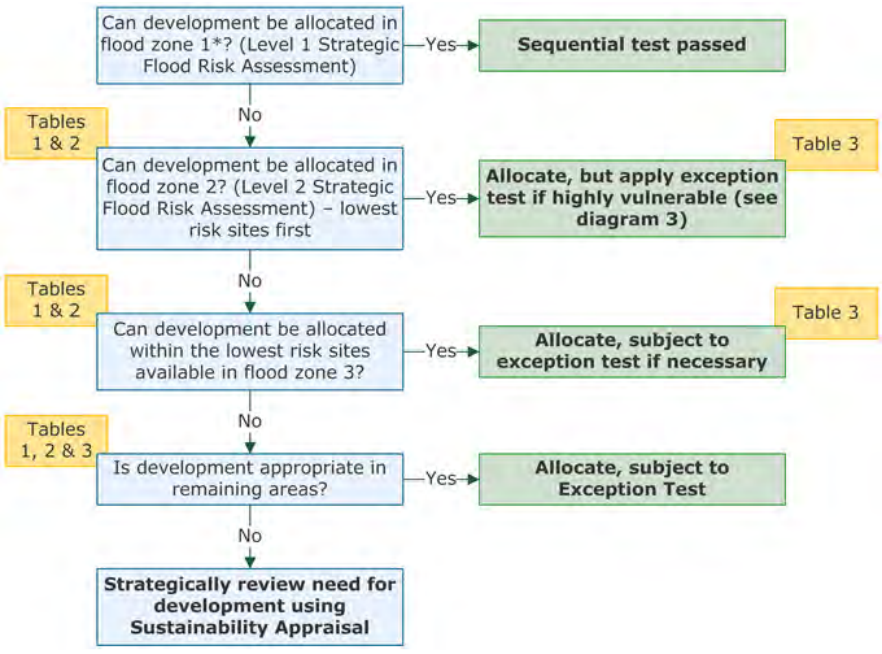
It is recognised that flood risk information should be considered alongside other local planning issues, including the sustainability appraisal process. These other issues include, for example, housing and employment needs, the natural environment and other planning policy constraints and considerations. This other information is relevant to defining whether alternative locations are reasonable, sustainable and in sufficient quantities. Thus potential sites to be allocated for

development are tested on the basis of their flood risk attributes and the outcome used to inform decisions along with the results from other considerations.

To perform the Sequential Test Barrow BC needs to be aware of what sites are reasonably available within the Borough. It is necessary to define 'reasonably available' and be able to provide evidence that there are no locations outside of those considered with a lower probability of flooding that could be considered reasonably available. When applying the Sequential Test it will be important to demonstrate that a transparent process has been formulated and followed; that this process has sought to steer development to areas with the lowest probability of flooding, where possible; and that full consideration has been given to reasonably available alternatives on land with a lower probability of flooding, consistent with other policy requirements.

Figure 7.1 shows a flowchart for use by Barrow BC in the application of the Sequential Test. It is a tool to help the decision-maker locate a proposed development in lower flood risk categories. The table that follows, Table 6.1, contains additional notes which direct the user to particular chapters of technical information of mapping within this SFRA and which should be used in each stage of the process.

The flood risk information required to address the four stages of the application of the Sequential Test noted above is provided in the flood maps in Chapter 5 of the SFRA. Specific guidance for use of these flood maps in the application of the Sequential test is provided in Table 7.1. Extracts from the NPPG in this SFRA are provided as a guide only and should be read in conjunction with the entire NPPG and not relied upon without such reference.



Notes:
Table 1 of the NPPG is reproduced as Table 7.1 below.
Table 2 of the NPPG is reproduced as Table 7.2 below
Table 3 of the NPPG is reproduced as Table 7.3 below

Figure 7.1: Sequential Test application flow chart from NPPG

Flood Zone	Definition
Zone 1, Low Probability	Land having a less than 1 in 1000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2, Medium Probability	Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding: or Land having between a 1 in 200 and 1 in 1000 annual probability of sea flooding (Land shown in light blue on the Flood Map)
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 (Land shown in dark blue on the Flood Map)

Table 7.1: NPPG Table 1: Flood Zones

Essential Infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood
- Wind turbines

Highly Vulnerable

- Police and ambulance stations; fire station and command centres; telecommunications installations required to be operational during flooding
- Emergency dispersal points
- Basement dwellings
- Caravans, mobile homes and park homes intended for permanent residential use
- Installations requiring hazardous substances consent (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure')

More Vulnerable

- Hospitals
- Residential institutions, such as residential care homes, children's homes, social services homes, prisons and hostels
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels
- Non-residential uses for health services, nurseries and educational establishments
- Landfill* and sites used for waste management facilities for hazardous waste
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan

Less Vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in 'More Vulnerable' class; and assembly and leisure
- Land and buildings used for agriculture and forestry

- Waste treatment (except landfill* and hazardous waste facilities)
- Minerals working and processing (except for sand and gravel working)
- Water treatment works which do not need to remain operational during times of flood
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place

Water-compatible Development

- Flood control infrastructure
- Water transmission infrastructure and pumping stations
- Sewage transmission infrastructure and pumping stations
- Sand and gravel working
- Docks, marinas wharves
- Navigation facilities
- Ministry of Defence installations
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location
- Water-based recreation (excluding sleeping accommodation)
- Lifeguard and coastguard stations
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category subject to a specific warning and evacuation plan

*Landfill is as defined in Schedule 10 to the Environmental Permitting (England and Wales) Regulations 2010.

Table 7.2: NPPG Table 2: Flood Risk Vulnerability Classification

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a[#]	Exception Test required[#]	x	Exception Test required	✓	✓
Zone 3b*	Exception Test required*	x	x	x	✓*

Key:

✓ Development is appropriate

x Development should not be permitted

[#] in Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood

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

- Remain operational and safe for users in times of flood
- Result in no net loss of floodplain storage
- Not impede water flows and not increase flood risk elsewhere

Table 7.3: NPPG Table 3: Flood risk vulnerability and flood zone 'compatibility'

Stage in Sequential Test	Guidance	Associated figure in SFRA
1. Are there reasonably available sites in Zone 1? Can development be allocated in Zone 1?	Barrow BC should use Flood Zone maps to identify areas of the Borough within Zone 1 and to consider whether there are appropriate locations for the allocation of development sites, or which are reasonably available for development, in Zone 1 areas. Barrow BC should use more detailed information within this SFRA to understand the extent and distribution of flood risk within Zone 1. Within Zone 1, areas at risk from other sources of flooding should be avoided where possible.	Figures 5.2 and 5.3 – EA Flood Zones And associated GIS layer
2. Where are the available sites in Zone 2? Should development be allocated to them?	Barrow BC should initially use Flood Zone maps to identify areas of the Borough within Zone 2 and consider whether these are appropriate locations for the allocation of development sites, or which are reasonably available for development. Barrow BC should use more detailed information within this SFRA to understand the extent and distribution of flood risk within Zone 2. Within Zone 2, development in areas at risk from other sources of flooding should be avoided where possible.	Figures 5.2 and 5.3 – EA Flood Zones and associated GIS layer
3. Where are the lowest risk available sites in Zone 3? Should development be allocated to them?	Barrow BC should use more detailed information within the SFRA to understand the extent and distribution of flood risk within Flood Zone 3. The Flood Zones do not take account of existing control structures and defences. Within Zone 3, areas at risk from other sources of flooding should be avoided where possible. Barrow BC should consider the potential impacts of climate change as discussed in Chapter 5, on different sources of flooding.	Accompanying ForeCoast JVis GeoPDF Figures 5.5 and 5.6 Surface water flood risk areas and associated GIS layer
4. Is development appropriate within the resulting areas?	In considering the appropriateness of development in remaining areas, Barrow BC should consider the vulnerability of the proposed development and Tables 2 and 3 of the Online Planning Practice Guidance to the NPPF. Barrow BC should also consider the potential impacts from climate change, as discussed in Chapter 5, on different sources of flooding.	None

Table 7-4: How to apply the Sequential Test

It should be noted when applying the process outlined above that the EA's Flood Map does not take into account small watercourses with a catchment area of less than 3km^2. As such the Flood Map will not provide flood extents for many Ordinary Watercourses: that is rivers, streams, ditches, drains, cuts, sluices, sewers (other than public sewers) and passages through which water flows that do not form part of a main river.

However, the Area Susceptible to Surface Water Flooding (AStSWF) map (Figures 5.5 and 5.6) can be a useful source of information to understand the potential flood risk associated with an Ordinary Watercourse. It must be understood that the AStSWF dataset does not provide a detailed assessment of fluvial flood zones, and therefore, should only be considered an indication of where Ordinary Watercourses may pose a risk of flooding. **It is recommended that where new development is proposed near to Ordinary Watercourses that a Flood Risk Assessment is undertaken in support of that development and that this includes an assessment of, and if necessary measures to manage, the risk to and from these watercourses.**

7.3 Exception Test

The Exception Test provides a method of managing flood risk while still allowing necessary development. Where application of the Sequential Test shows that there are insufficient reasonably available sites for appropriate the proposed development in areas with a lower probability of flooding, the NPPF Online Planning Practice Guidance sets out the circumstances in which an Exception Test can be undertaken, in effect to see if the development is acceptable in flood risk terms in an area at greater risk of flooding. It also sets out where the Exception Test, and in effect a particular type of development, is not appropriate.

The guidance makes clear that where they are in place SFRAs provide a basis for applying the Sequential Test and the Exception Test. There are two parts to Exception Tests and both of these must be passed for the potential site to be allocated or permitted:

- 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 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.

Figure 7.2 highlights the stages in the Sequential Test at which the Exception Test may need to be applied. Figure 7.3 presents the process that should be followed by Barrow BC in its application of the Exception Test.

The first part of the Exception Test refers to the wider sustainability benefits of the development. These may be considered through the sustainability assessment process for the site allocation process, or, for unallocated sites, by considering similar sustainability issues.

The second part of the Exception Test relates to the safety of the development and the need to not increase flood risk elsewhere. There are no fixed criteria for what constitutes a ‘safe’ development, as it will depend on factors such as the nature of the site, its detailed design and layout, the source and mechanism of flood risk and the vulnerability of land use or users.

However, appropriate application of the flood risk management hierarchy of ‘Avoid – Substitute – Control – Mitigate’ will increase the safety of a development. Table 7.5 outlines the data that should be used when considering the above aspects and when determining the safety of a development over its projected lifetime. Also, where possible, the following should be considered for new development that is within the floodplain and justification should be provided where this cannot be achieved:

- Development ground floor levels and access should be dry, particularly for More or Highly Vulnerable uses; and
- The Flood Hazard should be less than Significant (Dangerous for Most People) as defined within Defra/EA FD2321/TR1 *Flood Risks to People.* This implies a Hazard rating of less than 1.25, which correlates to fast-flowing shallow water and/or slow flowing deep water.

It is important that Barrow BC records the assumptions and decisions made with regards to the Sequential and Exception Tests.

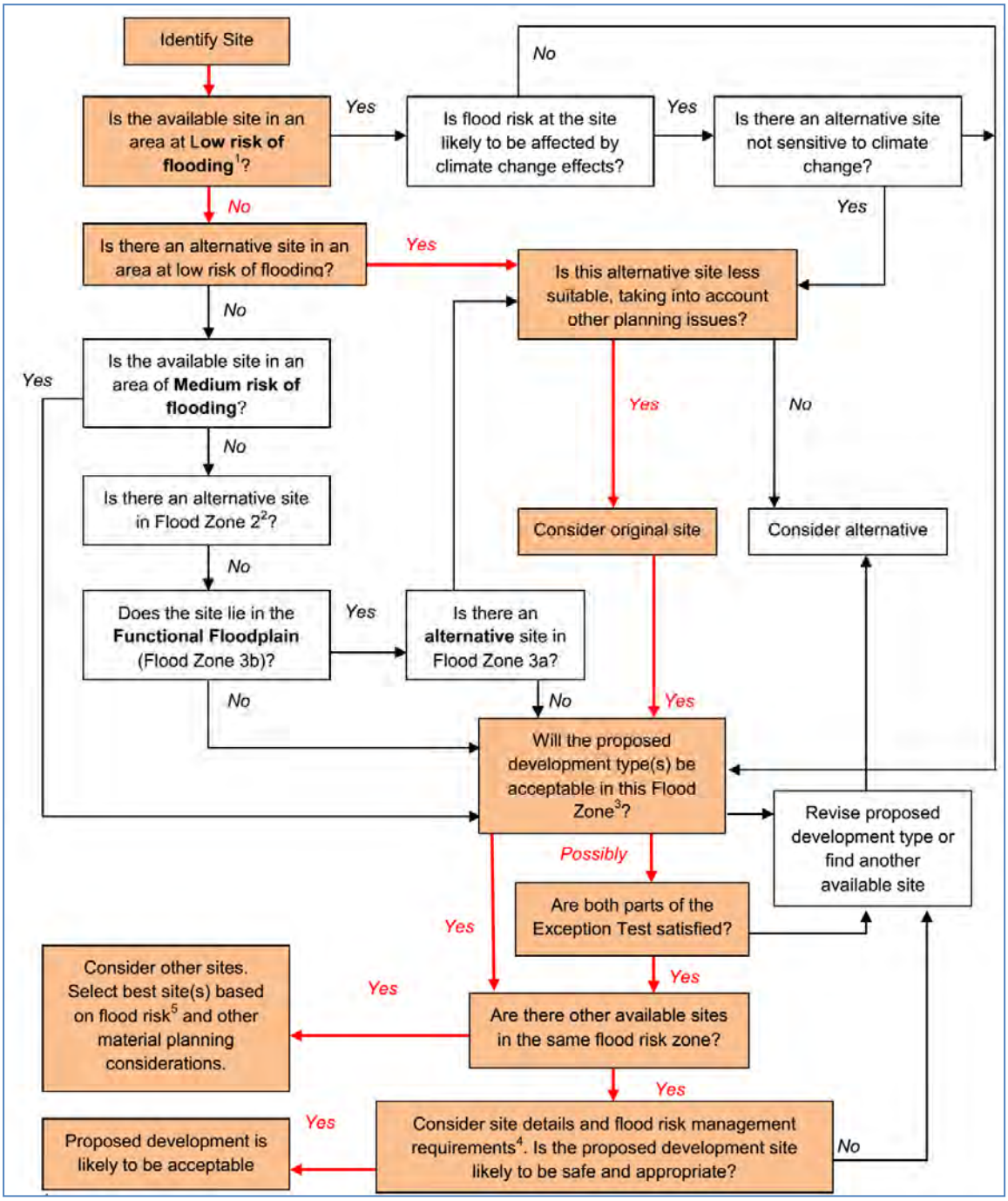
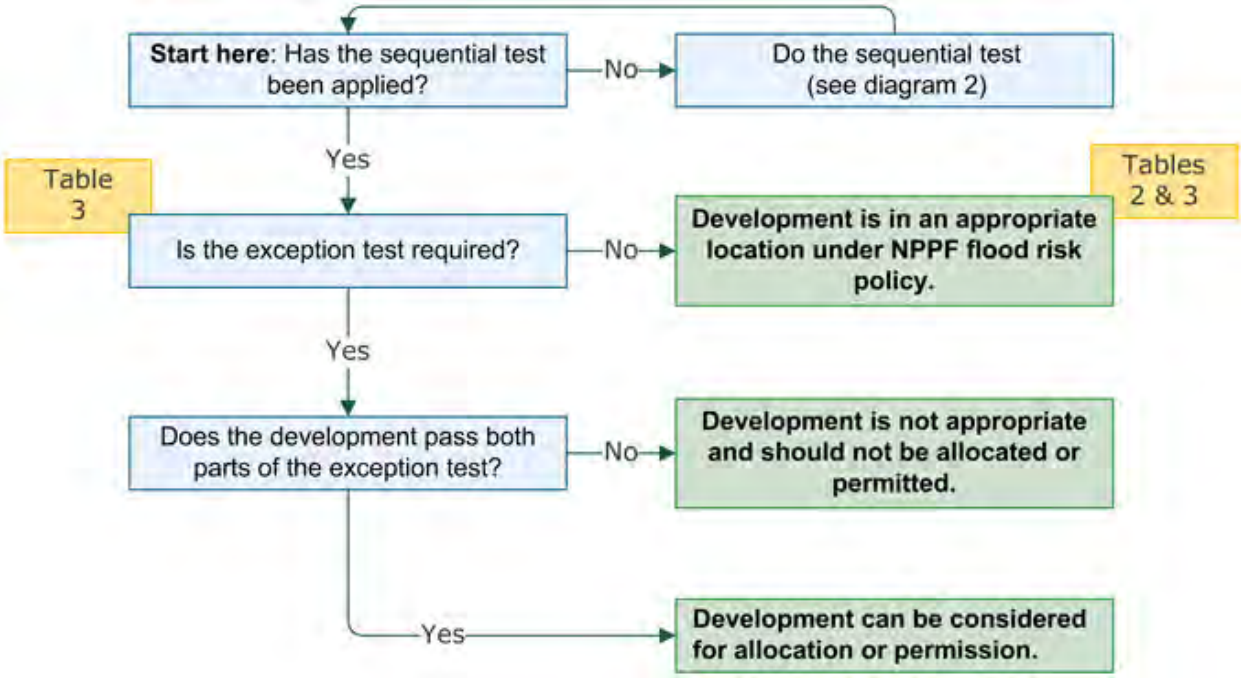


Figure 7.2: The process of allocating a site using the Sequential Test

[1]Flood Zone 1 for fluvial and tidal flooding and with low risk of flooding from other sources
[2]Flood Zone 2 for fluvial and tidal flooding with a medium risk of flooding from other sources
[3]As defined by the Sequential Test
[4]Development to be safe and to not increase flood risk elsewhere. Required to pass the Exception test, where applicable
[5]Including to susceptibility to future climate change and residual flood risk



Notes:
Table 2 of the NPPG is reproduced as Table 7.2 above
Table 3 of the NPPG is reproduced as Table 6.3 above

Figure 7.3: Application of the Exception Test

Source of Flood Risk	Key Information	Guidance	Information within the SFRA
Fluvial Flooding	Are there areas of the site with a risk of flooding taking into account the presence of defences? What is the probability of flooding within the site?	Avoid is possible, otherwise ensure that the vulnerability of the development matches the probability of flooding of the flood zone in which the development would be appropriate	Section 5.2 – site-specific flood risk assessments may be required
	What is the depth of flooding?	Seek to ensure that the internal ground floor levels are at least 600mm above the 1 in 100 annual probability flood level plus an allowance for climate change, particularly for More Vulnerable development within Flood Zone 3a.	Site-specific flood risk assessments may be required

Source of Flood Risk	Key Information	Guidance	Information within the SFRA
		Ensure access and egress routes are dry where possible	
	What is the velocity of flooding?	Where possible, seek to ensure that the velocity of flood water is sufficiently low to result in a nhazard rating that is no greater than 'Danger to Some', as defined in Defra/EA FD2321	Site-specific flood risk assessments may be required
	Is the site covered by EA Flood Warning Areas?	Ensure that the development has a Flood Warning/Evacuation Plan and that it is signed up to the EA's Automated Flood Warning Service	Consult with EA
Fluvial flooding from Ordinary Watercourses	Is there an Ordinary Watercourse within or adjacent to the site? Is the Ordinary Watercourse shown to flood within the relevant datasets?	If yes to both then ensure that there is an FRA and that mitigation measures are considered for flooding form Ordinary Watercourses, particularly those that may not be covered by the EA's Flood Zone Maps	Section 5.2 for known Ordinary Watercourses with flood risk and Fig. 5.1 for main river locations
Tidal Flooding	Are there areas of the site with a risk of flooding when taking into account the presence of defences? Is there a risk of failure of the tidal defences or overtopping?	Avoid if possible, otherwise ensure the vulnerability of the development matches the probability of flooding of the Flood Zone in which the development would be appropriate	Section 5.3 and Figs. 5.2 and 5.3 EA Flood Zones and associated GIS layers, accompanying ForeCoast JVis GeoPDF
	What is the depth of flooding?	Seek to ensure that the internal ground floor levels are at least 600mm above the 1 in 100 annual probability flood level plus an allowance for climate	Site-specific flood risk assessments may be required

Source of Flood Risk	Key Information	Guidance	Information within the SFRA
		change, particularly for More Vulnerable development within Flood Zone 3a. Ensure access and egress routes are dry where possible or that safe refuge is available	
	What is the velocity of flooding?	Where possible, seek to ensure that the velocity of flood water is sufficiently low to result in a hazard rating that is no greater than 'Danger to Some', as defined in Defra/EA FD2321.	Site-specific flood risk assessments may be required
	Is the site covered by EA Flood Warning Areas?	Ensure that the development has a Flood Warning/Evacuation Plan and that it is signed up to the EA's Automated Flood Warning Service	Consult with EA
Surface Water Flooding	Is the site at risk from surface water flooding? What is the probability of flooding?	Avoid areas at risk with a 1 in 30 annual probability of flooding where possible, otherwise ensure the vulnerability of the development matches the probability of flooding of the equivalent Flood Zone in which the development would be appropriate	Figures 5.5 and 5.6 Surface water flood risk areas and associated GIS layer
	What is the depth of flooding?	Seek to ensure where possible that the internal ground floor levels are above the 1 in 100 annual probability flood level plus an allowance for climate change, particularly for More Vulnerable	Site-specific flood risk assessments may be required

Source of Flood Risk	Key Information	Guidance	Information within the SFRA
		development. Ensure that flood resistant and flood resilient design is incorporated into the development, as appropriate ot the depth of flooding expected in residual flood risk events. Ensure access and egress routes are dry where possible or that safe refuge is available	
	What is the velocity of flooding?	Where possible seek to ensure that the velocity of flooding is sufficiently low to result in a hazard rating that is no greater than 'Danger to Some', as defined by Defra/EA FD2321	Site-specific flood risk assessments may be required
Groundwater Flooding	Is the site at risk or might be influenced by groundwater flooding?	Ensure that the FRA considers the risk form groundwater and considers the influence of groundwater on flood risk from other sources. Ensure that the drainage design and the potential use of SuDS takes into account the depth to groundwater as well as the potential for groundwater emergence	Figures 5.7 and 5.8 Groundwater flood risk areas and associated GIS layer
Flooding from Reservoirs	Is the site at risk of flooding from reservoirs?	Ensure that the FRA includes consultation with the EA, the appropriate reservoir owner/operator and Barrow BC's emergency planners. Where More Vulnerable	

Source of Flood Risk	Key Information	Guidance	Information within the SFRA
		development is proposed ensure that the consequences of reservoir failure on flood risk at the site has been identified and taken into account in flood risk management measures.	

Table 7.5: Information and guidance on assessing whether a site is 'safe'

7.4 Local Plan development site allocations and assessment of potential development sites in Barrow Borough

Site assessments have been undertaken as part of the SFRA on the current list of potential development sites identified by Barrow BC. More information on the sites is presented in Appendix B, including results of the assessment of flood risk using the methodology developed for the SFRA and described in Section 2.4.

The SFRA, the site assessments and the Sequential Test should inform Barrow BC's decisions on the allocation of these sites for development.

7.5 Flood risk management policies in the Local Plan

The SFRA provides evidence to inform Barrow BC's preparation of the Local Plan policies to manage flood risk from all sources. Chapter 4 draws together national, regional and local strategies, policies and other guidance relevant to management of flood risk, including sustainable surface water drainage. Chapter 5 provides information on the flood risk with Barrow Borough.

The SFRA, and notably Chapters 5 and 6 should inform the content, focus and priorities for Barrow BC's Local Plan policies for managing flood risk from all sources. These are primarily land use and development policies.

Sustainable Drainage Systems (SuDS)

The use of Sustainable Drainage Systems (SuDS) is recommended within the Online Planning Practice Guidance as a means by which drainage from new development can mimic as closely as possible natural drainage patterns and the natural runoff rates and volumes from undeveloped sites. The concept is supported by the hierarchy for drainage of surface water from a site in the current Building Regulations. It is also supported by the National Standards for SuDS and SuDS Approval Body (SAB) process, yet to be implemented.

By maximising infiltration and minimising runoff discharged to watercourses and sewers or through overland flow from the site, SuDS effectively seek to prevent runoff from a site contributing to flood risk elsewhere in frequent storm events, and to minimise the contribution to

flood risk in more extreme storm events. Use of SuDS should also reduce flood risk within the development site and ensure that any buildings or critical features are safe.

Helping make development safe – Flood Resilience and Resistance

Flood resilience measures decrease the time required for recovery after flooding and reduce the damage done by flooding and therefore reduce the cost of the consequences of flooding. Examples of flood resilience measures include waterproof plaster on the walls, solid concrete floors rather than wooden floors and electric circuits raised above the flood level. Flood resistance measures are designed to provide flood protection to individual properties and include measures such as, air brick covers, flood gates for doors and windows and non-return valves for drainage pipes.More details are available in guidance published by Communities and Local Government (CLG) and the Association of British Insurers.

Guidance from CLG indicates that a water exclusion strategy using flood resistance measures is appropriate for a predicted water depth of below 0.3m. Where predicted depths are between 0.3m and 0.6m combined flood resistance and flood resilience is recommended, to protect the property from low levels of flooding and to provide quicker recovery from higher levels of flooding. Where predicted depths are greater than 0.6m a water entry strategy using flood resilience measures is appropriate.

For all new development it is good practice and it is recommended to have finished floor levels at least 0.3m above the finished ground level.

7.6 Consultation

In preparing local plans, local planning authorities such as Barrow BC have a legal duty to cooperate with other local authorities and a number of public bodies, including the Environment Agency. The EA have been involved in the preparation of this SFRA, mainly by providing much of the data that underpins its assessment of flood risk, and have been consulted on the draft strategy before the final version was published.

8. How to use the SFRA in Development Management

8.1 Introduction

The SFRA has a specific role in development management in relation to planning applications and other planning-related consents. The SFRA help set the context within which all planning applications should be considered.

In summary the SDFRA provides the evidence to:

- Direct development away from areas at greater risk of flooding and manage residual risk, taking into account the impacts of climate change, applying the risk-based; Sequential Test approach and where necessary the Exception Test.
- Inform the Sustainability Appraisal of the Local Plan;
- Make sure that any development is safe, does not increase flood risk (from any source) elsewhere, and if possible reduces flood risk overall; and
- Inform the preparation and content of any site-specific flood risk assessments for development sites and help identify when site-specific flood risk assessment or flood risk management statements are required.

This Chapter focuses on the last two bullet points in relation to development management. Chapter 5 focuses on the first three bullet points in relation to Local Planning.

This Chapter first looks at the role of the SFRA in informing site specific flood risk assessments and provides additional information for developers. It then provides additional information for Barrow BC to aid in the process of determining planning applications and when providing pre-application advice.

8.2 Site-Specific Flood Risk Assessments

Site-specific Flood Risk Assessments (FRAs) are required to accompany planning applications for sites within Flood Zones 2 or 3, or where the site lies within Flood Zone 1 and is greater than 1 hectare in area or has critical drainage problems (as notified to the planning authority by the EA). Site-specific FRAs should assess the risks of all forms of flooding to and from development, taking climate change into account.

It is the responsibility of developers to consider flood risk to a site as early as possible. Developers should refer to the SFRA at the start of the pre-application stage, or if this is not carried out, as early as possible in the preparation of development proposals. The preparation of this SFRA does not remove the need for site-specific FRAs, but instead provides additional information and advice.

A site-specific FRA will need to demonstrate that flood risk to the development can be managed now and over the lifetime of the development from all sources of flooding. A site specific FRA should also demonstrate that the development does not increase the risk of flooding elsewhere. Wherever possible development should aim to reduce the level of overall flood risk and the FRA should demonstrate this where it is the case.

Consultation during the preparation of the site-specific FRA

Developers should liaise with Barrow BC to agree on who should be consulted. It is recommended that in all cases the developer should liaise with Barrow BC, including planning officers, flood and coastal erosion risk management officers and those providing drainage advice to the Council; the Environment Agency; United Utilities and where reservoir flooding is a risk, the owner/operator of the reservoir. Early consultation should help to avoid lengthy consultation following submission and potential planning objections.

The scope of any site-specific FRA should also be agreed with Barrow BC. This will be informed by the outputs of the SFRA and in consultation with the EA where necessary. Where the Sequential and Exception tests need to be applied within the site-specific FRA, pre-application discussions between the developer, Barrow BC, the EA and other relevant stakeholders should be used to scope out the availability of other sites. Pre-application consultation should also scope out what evidence is required to show that other sites have been considered.

Consultation with the Environment Agency

Due to the large number of consultations and the variety of planning applications received by the EA it has developed a consultation matrix which identifies when the EA should be consulted and what level of information needs to accompany the site-specific FRA if one is required. The consultation matrix is part of the EA's Flood Risk Standing Advice and is available on its website.

Consultation with United Utilities

Barrow Borough is extensively serviced by surface water, foul and combined sewers which are the responsibility of United Utilities (UU). Unless new development is to be located in an area in which soakaways can manage all surface water runoff, or is directly adjacent to a watercourse into which runoff can be discharged, it is likely that development runoff water will discharge into the local sewer network.

Developers should therefore, consult with UU as early as possible in the formulation of development proposals, to determine the capacity of the local drainage network to accept surface water runoff, as well as potential connection points. The starting point for considering developments is that wherever possible surface water runoff should not be discharged to the sewer network, unless it can be proved that this is the most sustainable option. Part H of the Building Regulations supports this position and presents a hierarchy for the management of surface water runoff with discharge to soakaway preferred first, followed by discharge to watercourse and finally to sewer.

The Flood and Water Management Act 2010 is set to remove the automatic right to connect to public surface water sewers in the future. This may require developers to provide more justification than is presently required in order to connect to the UU public sewer network.

Cross-boundary issues

Where a development site is close to the Borough boundary, or is likely to affect areas outside of the Borough, the developer may need to consult with South Lakeland District Council as well as Barrow BC.

The Sequential and Exception Tests

The site-specific FRA should apply the Sequential Test and, where appropriate the Exception Test unless the proposed development is located on a site that has been allocated for the type of development in a Local Plan, where the Local Plan has been sequentially tested and is supported by a SFRA. Also applications for minor development and changes of use are not subject to the Sequential or Exception Tests.

Where development is proposed outside of the allocated areas in the Local Plan and within flood risk areas set out in the SFRA, applicants are responsible for demonstrating that the proposed development satisfies the outcome of the Sequential Test and if necessary the Exception Test. The evidence required for the Tests is likely to include:

- Information on the levels of flood risk at the site;
- Information on the availability of 'reasonably available' sites in areas of lower flood risk;
- Information on the vulnerability classification of the development;
- Information on the wider sustainability benefits of the site (if the Exception Test is to be applied); and
- Information to show that the development will be safe.

In all cases a developer should apply the sequential approach to any flood risk within the site itself when determining the location of appropriate land uses within the site. The aim of this sequential approach is to minimise flood risk by considering the probability of flooding in conjunction with the vulnerability of receptors.

A site-specific FRA needs to demonstrate that flood risk to the development can be managed now and over the lifetime of the development from all sources of flooding. It also should not increase the risk of flooding elsewhere and demonstrate that the proposals are compliant with local planning policy.

9. Policy Guidance and Recommendations

9.1 Introduction

This chapter of the SFRA summarises the recommendations with regards to the development of flood risk policy by Barrow Borough Council. It includes consideration of flood risk management techniques as well as providing guidance on sustainable drainage requirements. These recommendations are based on the findings of the SFRA and current national policy and guidance.

The list of recommendations is not exhaustive and it is therefore recommended that Barrow BC additionally refer to key flood risk management documents and spatial planning documents to inform the development of its policies. The documents to be considered include the following:

- The NPPF Online Planning Practice Guidance
- Making Space for Water
- The North West Regional Flood Risk Appraisal
- Cumbria County Council PFRA
- The Cell 11 Shoreline Management Plan 2

There are areas at risk from all sources of flooding within Barrow Borough. The probability of flooding from surface water can be reduced on new developments by reducing the flow and volume of runoff from the site. Runoff should be controlled as close to the source as possible and the use of SuDS and the layout of sites should be designed so that areas at greatest risk of surface water flooding are avoided and that flow paths are maintained with no loss of storage on site.

As part of the SFRA recommendations for development management and Local Planning policy have been identified and they are presented in Table 9.1 below.

ID	Recommendation	Aspect	Local Plan (including allocations and policy)	Development Management
1	The Sequential Test, and where necessary, the Exception Test, should be applied to all new developments, in line with national planning policy	Sequential Test	✓	✓
2	Barrow BC should seek to apply the principle of directing development away from areas at greatest risk of flooding when allocating development sites. This should be through use of the Sequential Test and, where necessary, the Exception Test, where there are no other reasonably available alternatives on land with a lower probability of flooding, consistent with other planning policy issues and requirements. This applies principally to land within Flood Zones 2 and 3. Barrow BC should consider whether to apply the same principle to areas in Flood Zone 1, which are identified as having a high risk of surface water flooding.	Sequential Test	✓	
3	Where development is located within Flood Zone 2 or 3 it should be supported by a robust Sequential Test, and where necessary, and Exception Test.	Sequential Test	✓	✓
4	Where development is proposed within Flood Zone 2 or 3, Barrow BC should consider whether there are sites that currently lie in areas of lower flood risk that consist of lower vulnerability development that could feasibly be relocated to Flood Zone 2 or 3 to facilitate the new development being located within that lower flood risk zone, consistent with other planning policy issues and requirements.	Sequential Test	✓	
5	Barrow BC should consider whether there are opportunities to relocate areas of public open space within Flood Zone 1 into Flood Zone 2 or 3 in order to make more land available for new development within Flood Zone 1, consistent with other planning policy issues and requirements.	Sequential Test	✓	
6	In preparing site-specific Flood Risk Assessments, developers should, in line with the latest guidance, provide further information on the consequences of climate change on the flood risk to their developments.	Climate Change	✓	✓
7	Breach analysis may be required for new developments with a residual risk of flooding from breach failure of flood defences or infrastructure. Breach analysis should be carried out in accordance with best practice guidance and be used to inform flood risk management measures.	Climate Change		✓
8	Where development is proposed bordering defended watercourses and associated tributaries the design of new development should seek opportunities to set defences back from the watercourse in accordance with the principles of 'Making Space for Water' and other national planning guidance.	Climate Change	✓	✓
9	The risk of flooding from local sources, i.e. ordinary watercourses, surface water, groundwater and reservoirs, must be fully considered within site-specific Flood Risk Assessments and avoided or mitigated to an appropriate level within development sites. Potential flow paths or areas of ponding should be protected from inappropriate development.	Local Sources of Flood Risk		✓
10	Groundwater depths should be investigated as early as possible when planning new development, designing drainage (Especially SuDS) and assessing the risk of flooding. Information on groundwater level and infiltration rates at the location of proposed infiltration should be provided within a site-specific Flood Risk Assessment.	Groundwater		✓
11	In areas of groundwater emergence or where the susceptibility to groundwater flooding in Moderate to Very High it is recommended that consideration be given within a site-specific Flood Risk Assessment to the layout of the development relative to the topography such that where possible new-built or hard-surfaced development avoids potential flow paths and low-lying depressions within a site that might result from groundwater emergence or flooding.	Groundwater		✓
12	All site-specific Flood Risk Assessments and sustainable drainage applications should include an assessment of surface water management and should consider how surface water from a site will change as a result of the development and how surface water runoff will be managed in a sustainable manner. Surface water management strategies for new developments should demonstrate how the preferred approach has been reached.	Site-specific Flood Risk Assessments		✓
13	Development layouts should consider the effect of exceedence of the drainage system during the 1 in 100 year storm event with an allowance for climate change and should seek to ensure that no runoff can leave the site via overland flow paths by provision of appropriate storage within the drainage system or on the surface.	Sustainable Drainage Systems	✓	✓
14	Site-specific Flood Risk Assessments should consider the residual risks of flooding from all sources, looking at events that are more extreme than the standard of protection provided by defences (where there are any) or in the event of the failure of flood risk management infrastructure under normal design conditions.	Site-specific Flood Risk Assessment		✓
15	There should be no increase in flood risk elsewhere as a result of development. Site-specific Flood Risk Assessments should demonstrate that the development proposals would not increase flood risk from any source elsewhere (identifying and managing any potential risks).	Site-specific Flood Risk Assessment		✓
16	New development should seek to reduce the overall risk of flooding. Site-specific Flood Risk Assessments should set out whether and how the development proposals would positively contribute to a reduction in the risk of flooding overall.	Site-specific Flood Risk Assessments		✓
17	Site-specific Flood Risk Assessments should identify the vulnerability of the development over its lifetime. Opportunities to reduce the vulnerability classification of a site that is currently at flood risk through redevelopment of the site should be identified.	Site-specific Flood Risk Assessments		✓
18	Where opportunities to improve the standard of protection or condition of existing defences are available and which will provide protection to wider areas without increasing flood risk elsewhere, this should be considered as part of development proposals.	Flood Risk Management	✓	✓
19	Ground floor and basement access levels of More Vulnerable development should be 600mm above the 1 in 100 annual probability fluvial flood level or the 1 in 200 annual probability tidal flood level with an allowance for climate change, taking into account the presence of defences and the residual; risk of failure of those defences.	Flood Risk Management	✓	✓
20	Ground floor and basement access levels of all More Vulnerable development to be at least 300mm above the 1 in 100 annual probability surface water flood level with an allowance for climate change.	Flood Risk Management	✓	✓

ID	Recommendation	Aspect	Local Plan (including allocations and policy)	Development Management
21	Safe access and egress should be provided where possible for proposed developments. Safe access is considered to be 'dry' for More Vulnerable or Highly Vulnerable development unless under exceptional circumstance.	Flood Risk Management	✓	✓
22	Safe refuge should be provided in areas of residual tidal flood risk where dry access cannot be maintained. Safe can be considered to include suitable refuge at least 600mm above residual flood level in the event of failure of tidal defences. Buildings should be designed to withstand the water pressures and consequences of flooding.	Flood Risk Management	✓	✓
23	Developers should ensure that lessees and owners of new developments within areas that have a flood risk are made aware of the existing flood risks so that appropriate flood warning and emergency planning can be undertaken.	Flood Risk Management	✓	✓
24	Essential infrastructure should be designed so as to remain operational during times of flood.	Flood Risk Management	✓	✓
25	Where developments may be at residual risk of flooding, the use of flood resistance and flood resilience measures may be appropriate to manage that residual risk. Resistance and resilience measures alone are not appropriate forms of flood risk management for sites with anything other than a residual risk of flooding from any source.	Flood Risk Management		✓
26	Where development takes place within the floodplain, principal flow paths should be maintained by avoiding built development in areas of the highest velocity and depth.	Flood Risk Management	✓	✓
27	The Functional Floodplain should be safeguarded from new development other than water-compatible uses and essential infrastructure that has to be located within it. Appropriate opportunities should be taken to achieve environmental enhancement, including removing or reducing obstructions.	Flood Risk Management	✓	
28	Compensatory storage should be required where development that reduces flood storage takes place within fluvial/tidal Flood Zone 3 and within areas at risk from surface water flooding. Developments should explore opportunities to reduce the footprint of existing buildings within the floodplain.	Flood Risk Management	✓	✓
29	In line with the Land Drainage Act 1991 (Environment Agency) byelaws, development proposals should ensure that an 8m wide undeveloped buffer strip should be provided from the top of the bank of main rivers or from the landward toe of flood defences, and a 16m wide undeveloped buffer strip should be provided alongside tidal flood defences to allow for maintenance access.	Flood Risk Management		✓
30	In line with the principles of the Water Framework Directive and the EA's policy on culverts, Barrow BC should adopt a presumption against the further culverting of watercourses and should seek appropriate opportunities to de-culvert existing culverted watercourses, with consideration of flood risk and ground conditions and other planning policy issues and requirements.	Flood Risk Management	✓	✓
31	Barrow BC should require new Greenfield development to restrict runoff rates and volumes to those of the pre-developed site and should require new brownfield development to reduce existing runoff rates by 20%. Volumes for a 1 in 100 year 6 hour storm event should be no greater than from the pre-developed site in the same event. Where these requirements cannot be met then sufficient information should be provided to satisfactorily demonstrate why this is the case.	Sustainable Drainage Systems	✓	✓
32	As part of the sustainable management of surface water all major development proposals should take opportunities to incorporate green roofs where they are appropriate. Reference should be made to the Green Roof Code when considering the design of green roofs.	Sustainable Drainage Systems	✓	✓

Table 9-1: Policy recommendations for the Local Plan and Development Management

10. SFRA Maintenance and Management

10.1 Introduction

This chapter provides an introduction to the maintenance and management procedures that are required to ensure that the SFRA remains up-to-date and continues to make use of the best available information. Implementing a maintenance and management procedure for the SFRA will assist Barrow BC to regularly review the technical data available and to commission technical updates where necessary.

10.2 Data Collection

The datasets used in the Barrow Borough SFRA were supplied by:

- The Environment Agency;
- Barrow Borough Council, and;
- United Utilities.

Table 10.1 details the key datasets received in order to develop the SFRA. The SFRA is a living document and as such the contents of this table should be updated when the SFRA is revised and new data is incorporated. A record should be kept so that it is possible to attribute the data used to inform flood risk at any moment in time throughout the existence of the SFRA.

Data	Description	Source	Date
OS Mapping	GIS layer	Barrow BC	2014
Barrow BC Allocated Sites	GIS layer of potential development sites	Barrow BC	September 2014
Flood Zone Maps	GIS layer of fluvial and tidal flood zones	Environment Agency	August 2014
Areas Susceptible to Surface Water Flooding (AStSWF)	GIS layer of broad scale modelling of areas potentially at risk of surface water flooding	Environment Agency	July 2009
Flood Map for Surface Water Flooding (FMfSWF)	Updated GIS layers of broad scale modelling of areas potentially at risk of surface water flooding	Environment Agency	November 2010
Cumbria County Council Preliminary Flood Risk Assessment (PFRA)	An overview of sources of flood risk throughout Cumbria	Cumbria County Council	July 2011
Reservoir Inundation Mapping	Potential flood risk areas from breaches of reservoir embankments	Environment Agency	2009
Flood Event Outlines	Historic flood events	Environment Agency	2014
Areas Susceptible to	GIS layer of grid-based	Environment Agency	July 2009

Groundwater Flooding (AStGWF)	coarse risk assessment of the potential for groundwater flooding		
ForeCoast JVis Map of Barrow	Interactive Geopdf map showing tidal flood extents, depths and hazards for Barrow under various combinations of storm driving factors	Environment Agency	April 2014

Table 10-1: Data register

It is recommended that key contacts within the organisations in Table 9.1 are maintained to facilitate the updating of the SFRA and any future iteration following new studies. It should be noted that the surface water datasets do not include Walney Island and so it has not been possible to assess the flood risks from surface water on the Island. The Environment Agency should be encouraged to extend the datasets to include Walney Island in any future updates.

10.3 SFRA Data Management

The data management strategy for the SFRA is designed to take account of the likelihood that external parties will seek to make use of the information within the SFRA in preparing flood risk assessments and assessing the flood risk constraints at potential development sites. The SFRA is also a live document and as such it is necessary to ensure at regular intervals in the future that the information within it remains valid.

To ensure that the SFRA remains live it is important to monitor, maintain and manage it. It is recommended that the monitoring of the SFRA is linked to the Borough Council's Local Plan Monitoring Report. By following this process of information dissemination and review it can be ensured a consistent approach is taken to monitoring and updating the SFRA. Updating would typically involve obtaining the latest datasets and mapping GIS layers rather than undertaking extensive new or updated modelling. Figure 9.1 shows a conceptual model for the SFRA management process.

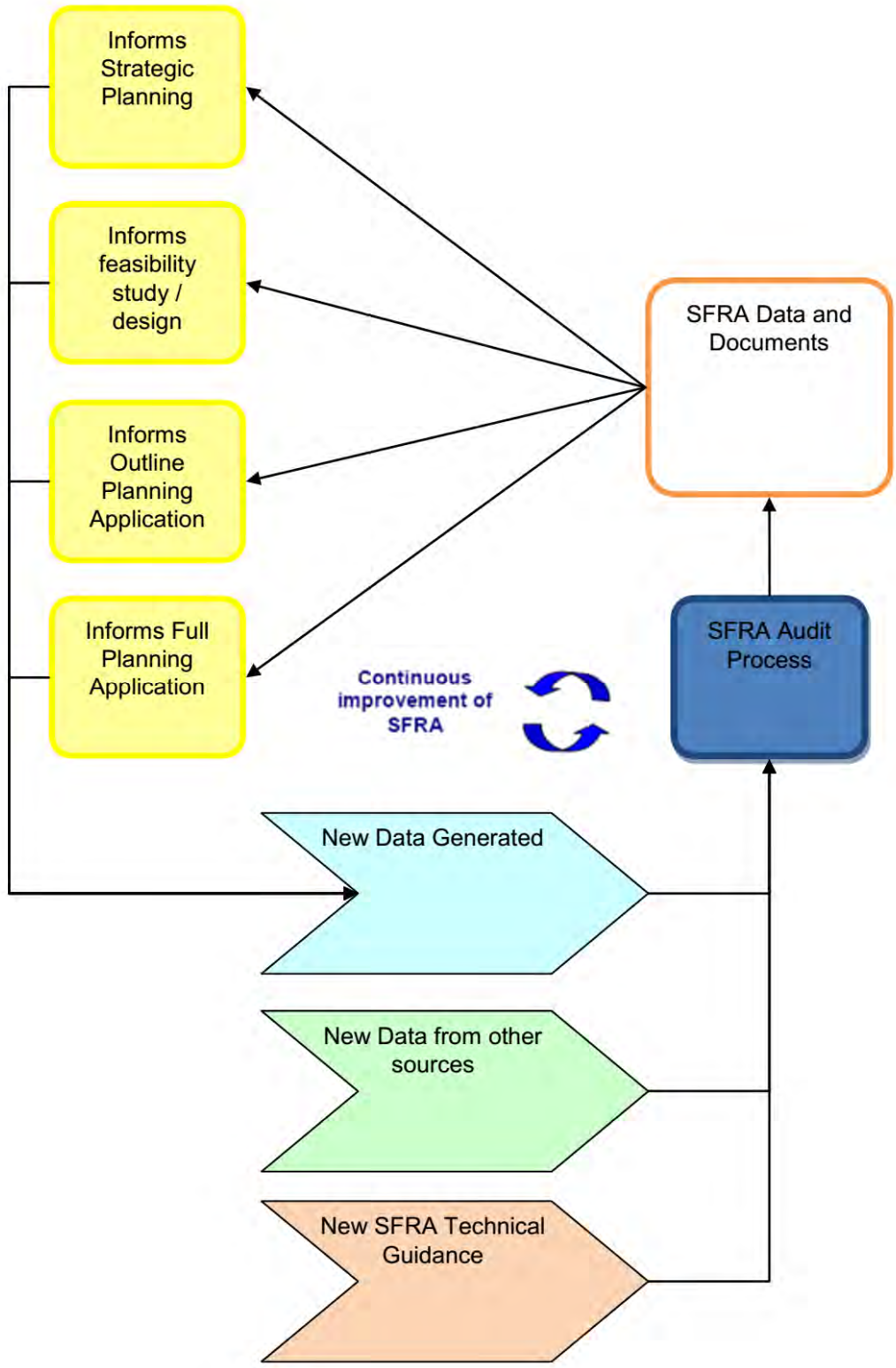


Figure 10.1: Conceptual SFRA management process

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Appendix A – Glossary

Term	Definition
AEP	Annual exceedance of probability. The annual chance of experiencing a flood with the corresponding flood magnitude, i.e. a 1 in 100 annual probability event flood is a flood with a flow magnitude that has a 1 in 100 annual probability of occurring in each and very year
ABD	Areas benefitting from defences. Those areas that are protected against flooding by flood defences with a standard of protection (SoP) equivalent to a 1 in 100 annual probability flood event
ABI	Association of British Insurers
AOD	Above Ordnance Datum. A topographic reference system that relates ground levels to a datum point established at Newlyn, Cornwall
Areas Susceptible to Surface Water Flooding (AStSWF)	National scale surface water flood modelling published in 2009. Three bandings are indicated, showing Less to More Susceptible
Areas Susceptible to Groundwater Flooding (AStGWF)	|A strategic scale map showing groundwater flood areas on a 1km square grid. Shows the proportion of each grid square where geological and hydrogeological conditions show that groundwater might emerge
Breach or failure hazard	Hazards attributed to flooding caused by a breach or failure of flood defences or other infrastructure which is acting as a flood defence
Building Regulations	Building Regulations promote standards that apply to most aspects of a building's construction, energy efficiency and covers drainage and waste disposal
BRE	Building Research Establishment – www.bre.co.uk
CFMP	Catchment Flood Management Plan. A high-level planning strategy through which the Environment Agency works with key decision makers within a river catchment to identify and agree policies to secure the long-term sustainable management of flood risk
CIRIA	Construction Industry Research and Information Association – www.ciria.org
CLG	Communities and Local Government. The Government department responsible for national planning policy guidance – www.gov.uk/government/organisations/department-for-communities-and-local-government
Climate Change	Long term variations in global temperatures and weather patterns
DEFRA/Defra	Department for Environment and Rural Affairs. The Government department responsible for environmental protection, agriculture, food production and standards as well as fisheries and rural communities – www.gov.uk/government/organisations/department-for-environment-food-rural-affairs
Developable Area	The area or portion of a site that is developable for a specific type of development/vulnerability class without application of the Exception Test.
DG5 Register	A water company held register of properties that have experienced sewer flooding to hydraulic overload, or properties which are 'at risk' of sewer flooding more frequently than once in 20 years.

Drift Geology	The name for all material of glacial origin found anywhere on land or at sea. Typically refers to deposits of Quaternary age (up to 2.6M years)
EA	Environment Agency. A non-departmental agency reporting to Defra charged with protecting to enhancing the environment and managing flood risk and pollution in England – www.gov.uk/government/organisations/environment-agency
Exception Test	The Exception Test should be applied following the application of the Sequential Test. It must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, is on developable land, the development is safe and will not increase flood risk elsewhere
Floodplain	Area of land that borders a watercourse, an estuary or the sea, over which water flows in time of flood, or would flow but for the presence of flood defences where they exist
Flood Map for Surface Water (FMfSW)	National scale surface water flood modelling published in 2009. Two bandings are provided, 'Surface Water Flooding' and 'Deeper Surface Water Flooding'. Which indicate surface water flooding greater than 0.1m and greater than 0.3m respectively. There are outputs available for events with a 1 in 30 and 1 in 200, annual probability of occurring in any one year.
Flood Risk	Flood risk is a combination of two components: the chance (probability) of a particular flood event and the impact (consequence) that the event would cause if it occurred
Flood Risk Vulnerability	Classifications of the vulnerability of particular land-uses to flooding
FRA	Flood Risk Assessment
Flood risk management	Flood risk management can reduce the probability of occurrence of flooding through the management of land, river systems and flood defence and reduce the impact through influencing development in flood risk areas, flood warnings and emergency response
Flood Zones	These are zones defined by the Environment Agency and included in their Flood Zone mapping
Fluvial	Referring to a watercourse (rivers or streams)
Freeboard	The height of the top of a bank or defence structure above the design water level
Groundwater	Groundwater is the term used to describe water that is stored underground in areas of permeable rocks, known as aquifers. Consistently high levels of groundwater can lead to groundwater flooding
GEM	Groundwater Emergence Maps identify those area of England where, in exceptionally wet periods, groundwater levels could be expected to be at, or close to, the ground surface. Where possible these maps have been calibrated based on observations made in the winter of 2000-01.
LFRMS	Local Flood Risk Management Strategy. Under the Flood and Water Management Act 2010 a Lead Local Flood Authority (LLFA) must produce a strategy for managing local flood risk from surface run off, ordinary watercourses and groundwater
LLFA	Lead Local Flood Authority. LLFAs are designated Local Authorities who are responsible for taking the lead on local flood risk management and whose duties are set out in the Flood and Water Management Act 2010. For Barrow the LLFA is Cumbria County Council
LiDAR	Light Detection and Ranging: a technique that uses lasers to measure ground and building levels remotely from the air.
LPA	Local Planning Authority

Main River	Main rivers are a statutory type of watercourse in England and Wales and in England all main rivers are as so defined by Defra. They are usually larger streams and rivers, but may also include some smaller watercourses. A main river can include and structure or appliance for controlling or regulating the flow of water into, in or out of a main river. The EA's powers to carry out flood defence works apply to main rivers only.
NGR	National Grid Reference
MAFP	Multi-Agency Flood Plan: and emergency plan focussed specifically on the complex issues associated with flooding that can be prepared by a Local Resilience Forum or Local Planning Authority
Ordinary Watercourse	All watercourses that are not designated as main river are ordinary watercourses. These are the responsibility of Lead Local Flood Authorities or Internal Drainage Boards
PFRA	Preliminary Flood Risk Assessment. A statutory requirement of the Flood Risk Regulations which implement the requirements of the European Floods Directive.
Policy Unit	A defined area within which the EA CFMP policies are implemented.
Receptor	A property, business or land-use which is at risk from flooding
Residual Risk	Flood risk resulting from an event which is more severe than that for which particular flood defences have been designed to provide protection
RBMP	River Basin Management Plan. A strategic document that sets out measures to protect and improve the water environment.
Sequential Test	Test to determine if there are other reasonably available sites in areas with a lower probability of flooding that would be appropriate to the type of development or land use proposed
SFRA	Strategic Flood Risk Assessment
SoP	Standard of Protection. The actual or design standard of protection afforded by a flood defence
SuDS	Sustainable Drainage System
SWMP	Surface Water Management Plan