ATKINS

Plan Design Enable

Page left blank intentionally

Knowsley Council and Sefton Council

Strategic Flood Risk Assessment

5074164/DG/003

Notice

This report was produced by Atkins for Knowsley Council and Sefton Council for the specific purpose of the Strategic Flood Risk Assessment.

This report may not be used by any person other than Knowsley Council and Sefton Council without the express written permission of ATKINS. In any event, Atkins accepts no liability for any costs, liabilities or losses arising as a result of the use of or reliance upon the contents of this report by any person other than Knowsley Council and Sefton Council.

Atkins Limited

Document History

JOB NUMBER: 5074164			DOCUMENT REF: 5074164/DG/003			
F3	Final	OT	SF	OT	MJ	22/06/09
F2	Final - corrected	NB/TJ	NM	SF	OT	01/06/09
F2	Final - resubmitted	NB/TJ	NM	SF	OT	21/05/09
F1	Final	NB/TJ	SF	MH	OT	23/03/09
D7	Final Draft	NB/TJ	EA	SF	OT	17/09/08
D1	Draft	NB/TJ				09/2008
Revision	Purpose Description	Originated	Checked	Reviewed	Authorised	Date

Page left blank intentionally

Contents

Section Page

List of Tables

Appendices

Glossary

Acronym	Description
ABD	Area Benefitting from Defences
AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
CFMP	Catchment Flood Risk Management Plan
DG5 Register	Register within the Director General of OFWAT's Report on Issue Number 5
DPD	Development Plan Document
Flood Map	Environment Agency mapping showing fluvial and tidal flood extents for various probabilities of storm event
Flood Zone	PPS25 flood extents based on Flood Map data and supported by other relevant flood data where available
FRA	Flood Risk Assessment (site specific)
GEM	Groundwater Emergence Maps
LDD	Local Development Documents
LDF	Local Development Framework
LiDAR	Light Detection and Ranging aerial survey
LPA	Local Planning Authority
MEAS	Merseyside Environmental Advisory Service
NFCDD	National Flood and Coastal Defence Database
PAR	Project Appraisal Report
PPS1	Planning Policy Statement 1: Delivering Sustainable Development
PPS10	Planning Policy Statement 10: Planning for Sustainable Waste Management
PPS25	Planning Policy Statement 25: Development and Flood Risk
PPS3	Planning Policy Statement 3: Housing
RFRA	Regional Flood Risk Assessment
RPB	Regional Planning Body
RSS	Regional Spatial Strategy
SFRA	Strategic Flood Risk Assessment
SMP	Shoreline Management Plan
UDP	Unitary Development Plan

Page left blank intentionally

1. Introduction

1.1 Background to Study

Knowsley and Sefton Borough Councils commissioned Atkins, in April 2008, to undertake a Strategic Flood Risk Assessment (SFRA) for the two Boroughs. The SFRA was undertaken in accordance with Government guidance set down in Planning Policy Statement 25 "Development and Flood Risk" (PPS25)[1] and the best practice guide ("Planning Policy Statement 25: Development and Flood Risk Practice Guide").

The SFRA is a hybrid of a Level 1 assessment at a Borough wide level for each Borough combined with a more detailed assessment. The detailed aspects incorporate elements of; a Level 2 SFRA for specified regeneration /development areas and sites; and sites identified in the strategic housing land assessment and employment land study.

The purpose of the SFRA is to clarify and refine available flood risk information and to inform the planning decision making processes. This will enable robust and reliable decisions to be made on locations for development and growth. The information is firstly used by Local Planning Authorities (LPAs), in preparing their Core Strategies and other future Local Development Documents (LDDs). It can also be used by developers in their appraisal of potential development sites and the scoping of site specific Flood Risk Assessment (FRAs) should they be necessary.

It is important to remember that this is intended to be a live document and therefore should be revised regularly to incorporate new information and understanding of flood risk as and when it becomes available for the Knowsley and Sefton areas.

1.2 Overview

PPS25 states that a Strategic Flood Risk Assessment (SFRA) "should be carried out by the local planning authority to inform the preparation of its Local Development Documents, having regard to catchment-wide flooding issues which affect the area." In June 2008 Atkins was commissioned by Knowsley and Sefton Councils to develop a Level 1 SFRA, with some Level 2 elements, to inform the preparation of the Core Strategies and Allocation Development Plan Documents for the Boroughs. A key aspect of the core strategies, to be prepared as part of the Local Development Framework (LDF), will be to provide frameworks for the future location of development within the Boroughs.

The Environment Agency have been consulted throughout the development of this SFRA and agree with the methodology adopted.

Knowsley

Knowsley has a population of approximately 150,000, mainly residing in the towns of Kirkby, Huyton, Prescot, Whiston and Halewood.

Knowsley underwent rapid urban growth up to the 1970's as a result of overspill from the expansion of Liverpool at that time. This led to a very large council house building programme focused on young families with children. The recession of the 1970's and 80's resulted in a quick population decline in the area, connected with a poor choice of housing to buy, a surplus of education buildings and social difficulties. (Knowsley UDP, 2006)

Sefton

The Borough of Sefton has a population of approximately 281,000, mainly residing in the freestanding settlements of Southport, Formby and Maghull; and in Crosby and Bootle which form the northern part of the greater Liverpool conurbation. Around 50% of Sefton Borough is Green Belt

[1] Planning Policy Statement 25: Development and Flood Risk. Department for Communities and Local Government (December 2006)

land;- including the Sefton Coast which is internationally important for nature conservation, and other rural areas where agricultural land quality is generally high.

Economic activity is concentrated within a few strategic locations including the port and maritime zone, the industrial and commercial Dunnings Bridge Road Corridor in Bootle and Netherton, the central commercial and retail areas in Bootle and Southport, and Southport seafront. Sefton's tourism industry is based around Aintree racecourse, Southport seaside resort and the large number of golf courses in the area.

1.3 Future Development within Knowsley and Sefton

Good transport links exist within the Boroughs which can assist with further economic regeneration through employment and new housing developments. Both Knowsley and Sefton have proposed developments to the transport networks within their boundaries.

In addition to transport development of the Merseyside rail link, there are also plans to develop specific areas to improve the amount and quality of housing contained in the Boroughs. These locations are spread around the Knowsley and Sefton area, however a large concentration can be found in Bootle and North Huyton. Several sites are earmarked for industrial development, with a large cluster at Netherton and Knowsley Industrial Park. Other sites have been allocated to retail, employment and other development uses.

1.4 Need for a Flood Risk Assessment

Flooding is the most widespread and frequently occurring of natural hazards and, therefore, flood risk is one of many factors that should influence the spatial planning process. All forms of flooding and their impact on the natural and built environment are significant planning considerations.

Planning Policy Statements set out the Government's national policies on different aspects of land use planning in England. Planning Policy Statement 1: Delivering Sustainable Development (PPS1) sets out the Government's objectives for the planning system and describes how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and taking into consideration the impacts of climate change.

Planning Policy Statement 25: Development and Flood Risk (PPS25) complements other national planning policies and should be read in conjunction with National and European policies for flood risk and water management, including Making Space for Water[2] and the Water Framework Directive[3]. The aims of PPS25 are to ensure that flood risk is taken into account at all stages of the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk (the Sequential Test).

The Sequential Test splits the planning district into three distinct flood risk zones. Based upon the flood risk zone and subsequent land use definitions, PPS25 guidance is applied to determine development constraints. If for other planning reasons, new development is necessary in high risk areas the policy aims to make the development safe without increasing flood risk elsewhere and, where possible, reducing flood risk overall (the Exception Test).

PPS25 requires an assessment of flood risk to be carried out to an appropriate degree at all levels of the planning process viz:-

- a Regional Flood Risk Appraisal (RFRA) to inform the Regional Spatial Strategy (RSS);
- a Strategic Flood Risk Assessment (SFRA) to inform the Local Development Documents (LDDs); and

[2] Making Space for Water programme, cross Government programme taking forward the developing strategy for flood and coastal erosion risk management in England.
[3] EU Water Framework Directive 2000/60/EC, came into force 22 December 2000.

- a site-specific Flood Risk Assessment (FRA) to be submitted with planning applications for development in areas of flood risk, under the circumstances identified in PPS.

The Planning and Compulsory Purchase Act 2004 requires that a Sustainability Appraisal is undertaken for Regional Spatial Strategies, Development Plan Documents and Supplementary Planning Documents. Regional planning bodies (RPBs) and Local Planning Authorities (LPAs) are required under PPS1 to prepare and to implement planning strategies that help deliver sustainable development.

In developing their policies and strategies, RPBs and LPAs should work with the Environment Agency and other relevant operating authorities and stakeholders in appraising, managing and reducing flood risk in accordance with PPS25. As part of this process, RPBs should prepare Regional Flood Risk Appraisals (RFRAs) and LPAs should prepare Strategic Flood Risk Assessments (SFRAs) as freestanding assessments to contribute to the Sustainability Appraisal of their plans. PPS25 states that it is mandatory for LPAs to consult with the Environment Agency for planning applications for sites over 1 hectare in size or within areas identified to be at risk of flooding.

1.5 Objectives

The requirements for a Strategic Flood Risk Assessment are set out in PPS25 and a completed SFRA should:

- Provide sufficient data and information to enable the LPA to apply the Sequential Test to land use allocations and, where necessary, the Exception Test;
- Enable the LPA to prepare appropriate policies for the management of flood risk within the Local Development Documents (LDDs);
- Inform the Sustainability Appraisal so that flood risk is taken into account when considering options and preparing strategic land use policies;
- Identify the need for site specific FRAs in particular locations along with the level of detail required in these areas; and
- Enable LPAs to determine the acceptability of flood risk in relation to emergency planning capability.

1.6 Scope of this Document

The Knowsley and Sefton Council SFRA has been carried out and documented in accordance with PPS25. It summarises the data collection phase and the initial steps of the Sequential Test on the sites identified within the Unitary Development Plans for each Borough.

The report firstly provides an overview of the planning of development with regard to flood risk within Knowsley and Sefton (Section 2). A summary of the flood risk data made available for this SFRA and a review of this data is provided (Section 3) which then forms a basis for the assessment of flood risk in the Boroughs (Section 4, 5 and 6). The preparation for the Sequential Test is outlined for each of the allocated sites for development (Appendix H).

The SFRA provides the evidence base for flood risk which is a reference document for the Core Strategy and subsequent Local Development Documents. The SFRA also provides a reference document for consideration when assessing future development opportunities.

2. Review of Planning Policy

2.1 Introduction

This section provides an overview of planning policy in relation to flood risk and development within Knowsley and Sefton Council areas. Government guidance along with strategic and local planning policies provide the prevailing policy framework for the development of an SFRA and are identified below.

2.2 National Planning Policy Scope of this Document

The Government's overarching policy regime sets out national guidance on different aspects of land use planning. Regional Planning Bodies (RPBs) and Local Planning Authorities (LPAs) are required to take this into account for the preparation of Regional Spatial Strategies and Local Development Frameworks. The Government's national policies are contained within Planning Policy Statements (PPS). The key PPSs which would directly influence the scope of the SFRA, and those which would be relevant to flooding and water management, have been reviewed below.

- PPS1: Delivering Sustainable Development
- PPS3: Housing
- PPS25: Development and Flood Risk

2.2.1 PPS1: Delivering Sustainable Development

PPS1 sets out the Government's aims and objectives for delivering sustainable development through the planning system. One of the main components of planning, as set out in paragraph 1 of PPS1, is to ensure "that the right development takes place in the right location and at the right time." One of the key principles set out in PPS1 is to ensure that new development encourages sustainability for the lifetime of the development, taking due account of the physical environment and the impacts of climate change.

As part of delivering the sustainable development objectives, through paragraph 13, PPS1 requires RPBs and LPAs to consider climate change impacts, including flood risk, when taking decisions on the location and design of new development. In addition to this, Paragraph 13 also requires development plans prepared by the RPBs and LPAs to identify natural hazards which may affect new development and take appropriate action. In the case of areas at risk of flooding or sea level rise, the action is to avoid development in these zones, if possible. PPS1 recommends, in paragraph 36, that Planning Authorities prepare robust policies on design and access for new development. These should include a key objective to ensure developments are sustainable, taking into account natural hazards and the impacts of climate change, and to ensure such proposals are safe, durable and adaptable.

PPS1 Supplement – Planning and Climate Change

A supplement to PPS 1 (Delivering Sustainable Development) was published in December 2007 detailing the Government's views on how the planning system can contribute to reducing emissions and stabilising climate change; a key Government priority for the planning system. This supplement is intended to be read in conjunction with the national Planning Policy Statements and Guidance series.

The PPS1 Supplement reinforces PPS1 on issues of climate change. It makes recommendations, in paragraph 24, for issues the Local Planning Authorities should take into account when selecting land for development. These include known physical and environmental constraints such as sea-level rise and flood risk, and suggests that a "precautionary approach" is taken to increases in risk that could arise as a result of likely changes to the climate.

2.2.2 PPS3: Housing

PPS3 sets out the national planning policy framework for delivering the Government's housing objectives. The PPS provides advice and guidance relating to housing land delivery and requires that it should be taken into account by LPAs and RPBs in the preparation of their development plans. The Government's housing objectives can be achieved through a number of "outcomes" (such as housing developments in suitable locations) listed in paragraph 10 of PPS3 which the planning system should seek to deliver. In order to achieve these outcomes, PPS3 sets out policies based on a number of concepts and principles listed in paragraph 11. These include meeting the sustainable development requirements set out in PPS1, whilst taking into account climate change and flood risk.

PPS3 encourages the allocation of housing development in appropriate locations. When identifying broad locations for new housing development, PPS3, in paragraph 38, advises LPAs to take account of the constraints of the physical environment and natural hazards, such as flooding.

PPS3 also states, in paragraph 10, that a key objective of LPA should be to continue to make effective use of land by re-using those areas which have has been previously developed. In addition, the PPS states in paragraph 41 that the national annual target is for at least 60% of new housing to be provided on previously developed land. However, PPS3 also recognises that LPAs and RPBs "will need to consider sustainability issues for some sites as they may not be suitable for housing".

2.2.3 PPS25: Development and Flood Risk

PPS25 sets out the Government's polices with respect to development and flood risk. This is the key policy document for planning and flood risk and provides guidance on developing flood risk assessments. The PPS was issued in December 2006 and replaces the former Planning Policy Guidance Note 25 (PPG25). PPS25 complements other national planning policies and should be read in conjunction with Government and European policies for flood risk and water management, including Making Space for Water[4] and the Water Framework Directive[5].

The aims of PPS25 are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. As stated in paragraph 5 of PPS25, 'Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall'. The RPBs and LPAs are required to do this by Appraising Risk, Managing Risk, Reducing Risk and using a Partnership Approach. Of these requirements, Appraising the Risk is key to informing SFRAs and is undertaken by:

- Identifying land at risk, and the degree of risk of flooding from river, sea and other sources i.e. ground water and surface water ; and
- Preparing Regional Flood Risk Appraisals (RFRAs) or Strategic Flood Risk Assessments (SFRAs) as freestanding assessments that contributes to the sustainability appraisals of development plan documents.

In general, flood risk assessments assess the risks of all forms of flooding to and from development, taking into account climate change. At a regional level, the RFRA informs the Regional Spatial Strategy, taking into account any SFRAs that have been prepared.

PPS 25 requires that the SFRAs provide information at local (but not site specific) level regarding the catchment wide flooding issues which affect the area. They must also provide the information required by the LPA to inform the sustainability appraisal of Local Development Documents and to apply the Sequential Test. This information is then used as the evidence base to inform LPAs in the preparation of their LDF documents. These documents will include policies and site allocations, in

[4] Making Space for Water programme, cross Government programme taking forward the developing strategy for flood and coastal erosion risk management in England.
[5] EU Water Framework Directive 2000/60/EC, came into force 22 December 2000.

order to direct development to avoid flood risk to people and property where possible, and manage it elsewhere.

Sequential and Exceptions Test

The Sequential Test has been clarified by PPS25 and is to be used by LPAs when they allocate sites for development, or determine planning applications. In using the sequential test, sites are "zoned" in order of preference according to the flood risk identified by the SFRA. Although focusing on Flood Zones, the Sequential Test must consider all other known flood risk sources. Appropriate land uses for each Flood Zone are also listed to provide guidance for LPAs when they are considering appropriate use of sites within each zone. These Flood zones are contained within table D.3 from PPS25, reproduced below:

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✔	✔	✔	✔	✔
	Zone 2	✔	✔	Exception Test required	✔	✔
	Zone 3a	Exception Test required	✔	✗	Exception Test required	✔
	Zone 3b 'Functional Floodplain'	Exception Test required	✔	✗	✗	✗

Key:

✔ Development is appropriate

✗ Development should not be permitted

Note: Only when there are no reasonably available sites in Flood Zones 1 or 2 should decision makers consider the suitability of sites in Flood Zone 3.

Table 2.1: PPS25 Table D3

Paragraph D1 of PPS25 states that the Sequential Test is to be applied at all stages of planning, and its aim is to steer new development to areas at the lowest probability of flooding (Zone 1). Paragraph D5 of PPS25 explains that where there are no reasonably available sites in Flood Zone 1, the Sequential Test can be used to demonstrate that sites are allocated in areas of flood risk only when no sites of lower risk are reasonably available. The role of the SFRA is; to refine the reasonably available information on flood risk from all sources; to present this information for application of the Sequential Test; and to take into account other sources of flooding such as the impacts of climate change.

Where the Sequential Test cannot deliver appropriate, acceptable sites for development within areas of lower probability of flooding and development is required for "wider sustainable development reasons", as suggested in Paragraph 19, PPS 25 requires undertaking an Exception Test and this should be done as early as possible in the planning process. Paragraph 18 of PPS25 states that the Exception Test provides a method of managing flood risk while still allowing necessary development to occur. If there is a need to apply the Exception Test, the scope of future updates of this SFRA will be widened to consider the impact of any required flood risk management on the frequency, impact, speed of onset, depth and velocity of flooding within the Flood Zone.

In developing the SFRA, LPAs are required to work with the Environment Agency and other relevant operating authorities and stakeholders in appraising, managing and reducing flood risk. All forms of flooding should be considered, although the PPS25 Flood Zones are the main factor affecting Sequential Test results.

PPS25 Development and Flood Risk Practice Guide

A Practice Guide for PPS25 was published in June 2008 to provide further guidance on implementing the flood risk approach of "appraise, manage and reduce" identified within the PPS, showing how it can be achieved in practice.

Guidance is provided for all stages of flood risk assessment. It includes advice on how to apply the sequential test with case studies and examples of control and mitigation.

Chapter Three provides guidance on the differing levels of flood risk assessment and how the different types of flood risk should be assessed. Paragraph 3.35 states that Strategic Flood Risk Assessments:

"…*provide(s) the essential information on flood risk, taking climate change into account that allows the local planning authority (LPA) to understand the risk across its area so that the Sequential Test can be properly applied.*"

Advice and guidance on the general scope and role of the SFRA is provided in more detail, building on the policy provided in PPS25. In addition to this, paragraph 3.59 suggests that SFRAs should provide:

"…*information on the variation of risk within flood zones which are protected by flood defence infrastructure, draw appropriate conclusions and make recommendations for each potential development site*."

Further guidance on how the Sequential and Exception Tests should be applied to local spatial planning is provided within Chapter Four, whilst flood risk management and mitigation advice is provided in Chapter Six.

The information within the Practice Guide is presented to provide LPAs with the most up to date guidance on assessing flood risk which will, in turn, provide robust evidence for land allocation in Development Plan Documents.

2.3 Regional Planning Policy

2.3.1 Regional Spatial Planning

The North West Regional Spatial Strategy (RSS) was published in September 2008. The RSS for the North West sets out the development vision for the region by 2021. It provides a framework for all development in the region and sets priorities for dealing with identified regional and sub-regional issues, such as environmental issues. The RSS also provides a spatial framework for the development of other regional strategies, such as the Regional Economic Strategy and Regional Housing Strategy. All new planning documents currently being prepared by Knowsley and Sefton Councils will be required to generally conform to the RSS. The RSS forms part of the Development Plan against which planning applications have to be considered.

Policy DP1 sets out a number of spatial principles that underpin the RSS. These principles include the promotion of environmental quality, the reduction of emissions and adaptation to climate change. These principles have not only shaped the RSS, but are to be applied to all plans and strategies in the North West that affect development and management of land uses as well as to individual proposals. Policy DP9 sets out in more detail the approach to reducing emissions and adapting to climate change. In particular, plans, strategies, proposals, schemes and investment decisions should identify, assess and apply measures to ensure effective adaptation to likely environmental, social and economic impacts of climate change. Adaptation measures cited include, for example:

- minimising threats from, and the impact of, increased coastal erosion, increased storminess and flood risk, habitat disturbance, fragmentation and increased pressure on water supply and drainage systems; and
- Sustainable Urban Drainage.

Plans, strategies and schemes are, therefore, required by the RSS to address climate change by putting into place effective mitigation measures.

Two other polices of the RSS are of particular relevance to this report. They are:

Policy EM5 – Integrated Water Management

In achieving integrated water management and delivery of the EU Water Framework Directive, plans and strategies should have regard to River Basin Management Plans, Water Company Asset Management Plans, Catchment Flood Management Plans, and the Regional Flood Risk Appraisal. Local planning authorities and developers should protect the quantity and quality of surface, ground and coastal waters, and manage flood risk, by:

- working with the Water Companies and the Environment Agency when planning the location and phasing of development. Development should be located where there is spare capacity in the existing water supply and waste water treatment, sewer and strategic surface water mains capacity, insofar as this would be consistent with other planning objectives. Where this is not possible development must be phased so that new infrastructure capacity can be provided without environmental harm;
- producing sub-regional or district level strategic flood risk assessments, guided by the Regional Flood Risk Appraisal. Allocations of land for development should comply with the Sequential Test in PPS25. Departures from this should only be proposed in exceptional cases where suitable land at lower risk of flooding is not available and the benefits of development outweigh the risks from flooding;
- designing appropriate mitigation measures into the scheme, for any development which, exceptionally, must take place in current or future flood risk areas, to ensure it is protected to appropriate standards, provides suitable emergency access under flood conditions, and does not increase the risk of flooding elsewhere;
- requiring new development, including residential, commercial and transport development, to incorporate sustainable drainage systems and water conservation and efficiency measures to the highest contemporary standard;
- encouraging retrofitting of sustainable drainage systems and water efficiency within existing developments; and
- raising people's awareness of flood risks (particularly for vulnerable groups) and the impacts of their behaviours and lifestyles on water consumption.

Policy EM6 – Managing the North West's Coastline

Plans, strategies, proposals and schemes (including Shoreline Management Plans) should take a strategic and integrated approach to the long term management of flood and coastal erosion risk by:

- taking account of natural coastal change and the likely impacts of climate change, to ensure that development is sited or re-sited carefully to avoid:
  - the risk of future loss from coastal erosion, land instability and flooding;
  - unsustainable coastal defence costs; and
  - damaging existing defences and the capacity of the coast to form natural defences or to adjust to future changes without endangering life or property.
- making provision for mitigation of and adaptation to natural coastal change and the predicted effects of climate change over the medium to long-term (100 years) and supporting a 'whole shoreline approach' being taken to coastal risk management;

- minimizing the loss of coastal habitats and avoiding damage to coastal processes; and avoiding adverse impacts now and in the future on coastal sites of international nature conservation importance; and
- promoting managed realignment as a tool for managing flood and coastal erosion risk and delivering biodiversity targets and compensatory habitat requirements under the Habitats Directive.

2.3.2 Regional Spatial Strategy – Partial Plan Review 2008

A partial review of the RSS is proposed. However, this will be limited to matters relating to:

- Gypsies and Travellers;
- Travelling Show people; and
- Regional Car Parking Standards.

Subject to legislation, it is expected that the future wider review of RSS will be combined with that of the Regional Economic Strategy and prepared / published as a Single Regional Strategy.

4NW and the Regional Development Agency are to be responsible for its preparation.

2.4 Local Planning Policy

2.4.1 Knowsley Replacement Unitary Development Plan (Adopted June 2006)

The Knowsley Unitary Development Plan (UDP) was adopted in 2006. The development plan sets out the authorities' policies and proposals for the development and use of land in its area. The Plan provides the detailed policies and land allocations within the area consistent with national and regional policy. It is intended that many policies of the UDP will be saved before gradually being replaced by other documents in the LDF.

The UDP was undertaken before policy guidance update from PPG25 and therefore does not comply with the requirements set out in PPS25. However, there are policies within the plan which are relevant to flood risk and they are set out below.

POLICY ENV7: FLOOD RISK AND DRAINAGE

1. Development at an unacceptable risk of flooding will not be permitted. Where a development would be within an area of flood risk, the applicant will be required to:

a) Submit evidence to establish that the development could not be practicably located within an area of lower or no flood risk.

b) submit a flood risk assessment, which will fully assess the risks of flooding associated with the development in accordance with the requirements of Planning Policy Guidance note 25 "Development and Flood Risk".

2. Development will not be permitted if it may cause an unacceptable risk of flooding elsewhere.

3. Mitigation measures will be required, where necessary, to manage flood risk associated with or caused by new development. These should:

a) Be derived from a flood risk assessment;

b) Be fully described in the planning application;

c) Be fully funded - including for the provision of long-term maintenance - as part of the development; and

d) Contribute to the biodiversity resource of the Borough.

4. New development will not be permitted unless a Sustainable Drainage System is incorporated into the overall design. Exceptions may be made where it can be demonstrated that:

a) The Sustainable Drainage System would be likely to cause either significant land or water pollution; or

b) The site's ground conditions would preclude the use of a Sustainable Drainage System; or

c) The size of the site precludes the use of a Sustainable Drainage System; or

d) The proposed Sustainable Drainage System could cause damage to adjacent buildings or sites.

POLICY DQ1: DESIGN QUALITY IN NEW DEVELOPMENT

New development should be of a high quality design which will:

Site surroundings

a) Respond to and, where appropriate, enhance the characteristics of the immediate surrounding area through the use of appropriate scale, density, massing, height and building lines;

b) Preserve or enhance views of important landscape features/buildings in surrounding areas; and

c) Protect the amenities of neighbouring occupiers;

Site characteristics

d) Preserve any existing buildings, walls or structures which (whilst not necessarily statutorily listed), are of intrinsic architectural or historic interest, or which contribute to the character of the area;

e) Preserve and manage any existing important natural features such as trees, hedgerows, green space, ponds, slopes and streams and where possible make use of these as design features; and

f) Include measures to accommodate protected species and their habitats where these are seen to be relevant on nature conservation grounds.

Access

g) Provide safe and convenient access for all by a choice of transport, including attractive secure and safe defined pedestrian links to any community, employment, public transport and shopping facilities in the area.

Site layout and landscaping

h) Achieve an efficient use of land;

i) Provide an appropriate form of landscape treatment;

j) Provide high quality open spaces, designed to be well used and appreciated;

k) Provide good levels of amenity for occupiers of the development;

l) Create a clear distinction between the public and private realm; and

m) Include any necessary noise attenuation and flood abatement measures as an integral part of design.

Buildings and structures

n) Achieve good design quality in all new buildings and structures in terms of their scale, style, materials, detailing and their relationship with each other;

o) Maximise environmental efficiency through efficient use of materials and resources, re-use of materials wherever practicable, and the promotion of energy efficiency

Links to other approved strategies

Schemes for new development should take account of other relevant strategies and guidance drawn up by the local planning authority. In particular, regard should be had to the aims and objectives of any regeneration strategy which has been approved by the Council for the area concerned. Developers should also have regard to the Knowsley Council Design Guide which sets out appropriate design principles.

POLICY CP2: ENVIRONMENTAL ASSETS

1. All development should seek to either preserve or where possible enhance (both quantitatively and qualitatively) the following environmental assets within Knowsley:

- The openness and character of areas designated as Green Belt;
- The network of green spaces within and adjacent to Knowsley's urban areas;
- Knowsley's stock of Sites of Biological Interest, Nature Reserves, Sites of Local Geological Interest, and other sites, habitats and species which are identified as being of importance in the North Merseyside Biodiversity Action Plan;
- Knowsley's stock of trees, woodland, hedges, rivers, streams, lakes and ponds; and
- The buildings, features and areas, together with archaeological remains which represent the best of Knowsley's historic heritage.

2. New development will be required to contribute to the management and maintenance of environmental assets where this is necessary either to avoid long-term harm to the asset concerned or to ensure that environmental benefits associated with the development are achieved.

3. Development that would damage the above assets will only be permitted in exceptional circumstances where there is a clear and documented over-riding benefit arising from the development. In such cases, the Council will require mitigation measures to be implemented which will counter any loss in the environmental resource.

POLICY CP3: DEVELOPMENT QUALITY

All development proposals should seek to:

1. Provide an efficient use of land and buildings, which will minimise the need to build on undeveloped greenfield sites to meet overall development needs;

2. Provide a high design quality which will respond to and enhance the characteristics of the site and its surrounding area;

3. Protect and enhance the environment and amenities of people who live, work in and visit Knowsley;`

4. Avoid causing unacceptable levels of pollution of air, land or the water environment;

5. Avoid causing hazard from flood risk, the storage or use of notifiable hazardous substances, or land contamination or instability;

6. Include provision for safe and convenient accessibility to new development by a choice of transport, including walking, cycling and public transport; and

7. Reduce the threat of global warming, for example through environmentally efficient building design and the encouragement of the use of renewable energy sources.

POLICY MW5: WASTE MANAGEMENT AND TREATMENT FACILITIES

1. Proposals for new waste management facilities (or for the enlargement or amended operation of existing facilities) will be permitted where they are seen to be meeting the strategic

objectives set out in Policy MW4, subject to an assessment of their likely environmental impact or other harm. In determining applications for new or enlarged waste management facilities regard will be had to whether the proposed development would cause significant and unacceptable harm to any of the following:

a) Environmental resources or assets;

b) The visual character of the surrounding area;

c) the amenities of occupiers of nearby property (particularly residential property or other environmentally sensitive uses such as schools, hospitals or specialist industrial or business uses such as food processing and high technology uses) in terms of visual amenity, noise, vibration, dust, windblown material, smells, litter, vermin, air, land or water or other nuisance;

d) air safety, (including the need to safeguard the airspace around Liverpool John Lennon Airport and avoid birdstrike hazard); and

e) Road safety and highway capacity.

2. Proposals for waste management facilities should also be compatible with any approved regeneration strategy for the area in which they are proposed to be located.

3. Proposals for waste management facilities must include facilities for the recovery of materials for re-use and recycling and / or the recovery of energy from waste.

4. Planning permissions for temporary waste management uses and facilities may be made subject to planning conditions requiring reinstatement of the site, followed by after-care, to enable the subsequent use of the site for purposes agreed with the local planning authority.

5. Proposals for new superstores, supermarkets and other appropriate large developments with their own car parks, which are acceptable in principle, will only be permitted provided that recycling facilities are designed as an integral part of the development, so as to minimise their impact on amenity and traffic circulation.

POLICY MW6: LANDFILL OR LANDRAISING

Any planning application for landfill and/or landraising operations will need to satisfy the following additional criteria:

a) The type of material used for filling and the degree of compaction should be compatible with the proposed after-use;

b) Where the proposed development is located on a floodplain, the proposals will not have an unacceptable detrimental impact on flood attenuation capacity and would not impede the flow of flood waters;

c) The visual impact of finished contours (pre-settlement and post-settlement) must be acceptable;

d) Landfill and landraising schemes must have a positive contribution to landform and landscape quality on completion; and

e) Satisfactory means (such as interim restoration) must be used to ensure that damage to restoration caused by subsidence or landfill gas is minimised.

POLICY ENV1: CONTROL OF POLLUTION IN NEW DEVELOPMENT

Development will not be permitted which is likely to cause significant harm to amenity as a result of impact on any of the following:

a) Air quality;

b) The quality of land and soil (due to contamination); or

c) The quality of the water environment.

2.4.2 Knowsley Local Development Framework

The Council only recently produced a replacement UDP. The replacement UDP will be saved within the new system until replacement by the new Local Development Documents. It is envisaged that Knowsley Council will wish to save many of the UDP policies beyond the 3 years legislation automatically allows, and until at least the adoption of the Core Strategy which will form part of the Local Development Framework in 2011.

2.4.3 Sefton Unitary Development Plan (Adopted June 2006)

Sefton Council UDP was adopted in June 2006. Due to the latest requirement for local authorities to produce a Local Development Framework, the policies in the UDP will be saved before gradually being replaced by other documents in the Local Development Framework.

The UDP was produced and adopted pre PPS25 and therefore does not comply with policy set out in this planning guidance. In spite of this, there are policies set out in the UDP which are important to flood risk within Sefton. These are as follows:

POLICY CS2 RESTRAINT ON DEVELOPMENT AND PROTECTION OF ENVIRONMENTAL ASSETS

Development will not be permitted where it would cause significant harm to any of the following:

(a) The purposes of the Green Belt and its open character

(b) Rural landscape character

(c) The best and most versatile agricultural land

(d) The dune aquifer and associated coastal ecology

(e) The effectiveness of the open coast in forming a natural sea defence

(f) Sites and species of nature conservation importance

(g) Urban greenspace

(h) Sites of archaeological, historic or cultural importance.

Unavoidable losses must be compensated for by equivalent benefits, and in all cases development proposals and/or management regimes should seek to enhance the above assets.

POLICY CS3 DEVELOPMENT PRINCIPLES

The following general principles will be applied in the consideration of all development proposals:

(a) Development will provide for a choice of means of transport to and within the site, giving priority to pedestrians, cyclists and public transport users.

(b) Development would not be permitted if it would:

(i) Compromise road safety by site access or internal circulation issues; or

(ii) Cause significant harm to amenity, or to the character or appearance of the surrounding area; or

(iii) Create risk to people and property as a result of flooding, air or water pollution, land contamination, or noise or light nuisance; or

(iv) Prejudice the comprehensive development of the area.

(c) Significant weight will be attached to the quality of building and site design and layout, in particular for development which would be prominent because of its scale or location. The design of development shall have regard to:

(i) The needs of people who have disabilities;

(ii) The need for efficiency in the use of water, land and of non-renewable resources, including natural resources and energy; and

(iii) The need to make the proposal as sustainable as practicable.

(d) Planning conditions and legal agreements will be used where appropriate to make the most of the social, economic and environmental benefits of development.

POLICY CPZ1 DEVELOPMENT IN THE COASTAL PLANNING ZONE

1. Within the Coastal Planning Zone defined on the Proposals Map development will be restricted to uses which depend upon a coastal location. In Sefton these are:

• Port-related uses within the Port and Maritime zone;

• Leisure- and tourism-related uses within Southport Seafront;

• Development required to assist the management of the natural areas and landscape features of the open coast or required for coastal defence;

• Development related to the use of the coast for informal, countryside recreation; and

• Development comprising landfall facilities for off-shore installations.

2. Proposals for any of these uses are acceptable in principle.

POLICY CPZ2 COAST PROTECTION

1. Development will not be permitted which would:

(a) Increase the risk of tidal flooding or coastal erosion through its impact on coastal processes, or

(b) Impair the capacity of the coast to form a natural sea defence or adjust to changes in conditions without risk to life or property.

2. Proposals for built development within areas likely to be affected by coastal erosion will only be permitted where erosion or landslips are not likely to occur during the lifetime of the building.

POLICY CPZ3 COASTAL LANDSCAPE CONSERVATION AND MANAGEMENT

1. Development which is likely to significantly harm the coastal landscape will not be permitted.

2. Development which is likely to significantly harm the quantity and quality of the groundwater in the dune aquifer and the ecological features it supports will not be permitted.

3. Development within or affecting the Coastal Planning Zone will be expected to support the integrated management of the coastal landscape as a corridor which allows wild species to migrate, disperse and breed successfully. Development which significantly harms these interests will not be permitted.

4. Planning conditions or legal agreements may be used to secure any of the above.

POLICY DQ5 SUSTAINABLE DRAINAGE SYSTEMS

1. Proposals for new residential, commercial, industrial or leisure development will not be permitted unless a Sustainable Drainage System is incorporated into the overall design.

2. Exceptions may be made where it can be demonstrated that:

(a) the Sustainable Drainage System would be likely to cause either significant land or water pollution; or

(b) the site's ground conditions would preclude the use of a Sustainable Drainage System; or

(c) the size of the site precludes the use of a Sustainable Drainage System; or

(d) the proposed Sustainable Drainage System could cause damage to adjacent buildings or sites.

Procedures

3. Where appropriate planning conditions or legal agreements will be used to ensure that Sustainable Drainage Systems are provided and maintained.

POLICY EP1 MANAGING ENVIRONMENTAL RISK

Development proposals should demonstrate that environmental risks have been evaluated and appropriate measures have been taken to minimise the risks of harm or damage to people, property and the natural environment, from:

(a) Pollution of land, surface water, ground water and the air;

(b) Previously contaminated land;

(c) Hazardous substances;

(d) Noise, vibration and light nuisance;

(e) Flooding.

POLICY EP8 FLOOD RISK

1. Where development is likely to be at risk of flooding or increase the risk of flooding elsewhere, a flood risk assessment shall be submitted as part of the planning application.

2. Development which would be at unacceptable risk of flooding or would be likely to increase the risk of flooding elsewhere will not be permitted, unless the proposal contains adequate flood protection or mitigation measures.

3. Development will not be permitted if it increases the need for additional civil engineering or other works to prevent flooding. Exceptions may be made where the developer pays for the capital and maintenance costs of the necessary works.

Procedures

4. Planning conditions or legal agreements will be used to ensure that development is not at risk of flooding or likely to cause flooding elsewhere.

2.4.4 Sefton Local Development Framework

As part of the new planning system, Sefton Council will produce a series of Development Plan Documents and Supplementary Documents within the Local Development Framework as set out in the Council's Local Development Scheme which is updated annually.

One of the Development Plan Documents is the Core Strategy which lays out a vision for Sefton up to 2030. One of the issues the Core Strategy must consider is how the Council should respond to the challenges of climate change and increased flood risk.

The Council is in the early stages of production of this document (with Issues and Options consultation taking place in early summer 2009) and a series of background studies is nearing completion.

2.4.5 Joint Merseyside Waste Development Plan Document (DPD)

A Joint Waste Development Plan Document is being prepared for six local authorities across the Merseyside area including Halton, St Helens, Wirral, Sefton and Knowsley Borough Councils and Liverpool City Council. This document aims to provide a policy framework for sustainable waste management of all waste streams across Merseyside in compliance with PPS10 – Planning for Sustainable Waste Management. This study will identify sites across Merseyside which are suitable for new and better waste management facilities. This work is being prepared by the Merseyside Environmental Advisory Service (MEAS).

The Issues and Options report was published for consultation in March 2007 and it set out the discussion topics relating to the treatment and disposal of all waste types in Merseyside. It is expected that the final adoption of the Waste DPD will take place in 2011.

One of the issues discussed was the preferred locations for waste facilities. A list of possible locations was provided, with a secondary list of absolute constraints or sensitive receptors which would affect the location of waste facilities. One of these constraints is the flood plain, specifically areas which have been identified as having a 1in 100 year probability of flooding. Identification of a site within this flood risk would remove the site from consideration. Therefore, the information contained within flood risk assessments can impact on the location of all types of development, including waste facilities.

3. Data Collection and Review

3.1 Summary

The purpose of the data collection and review phase of the SFRA is to identify and obtain information regarding flood risk. It is during this phase that existing knowledge is collated with regards to; the sources and extent of flood risk; existing flood management measures; and the land use and development opportunities within the Knowsley and Sefton areas.

Consultations have been undertaken with Knowsley and Sefton Councils, adjoining planning authorities, the Environment Agency, British Waterways, United Utilities and the Merseyside Fire and Rescue Service.

The information gathered during this phase has been used to assess the potential extent and frequency of flood risk and the opportunities for flood management practices which may help mitigate or reduce future flood risk.

Figure 1 shows a flow diagram of the sequential approach of PPS25 with respect to siting appropriate land uses within areas of differing flood risk.

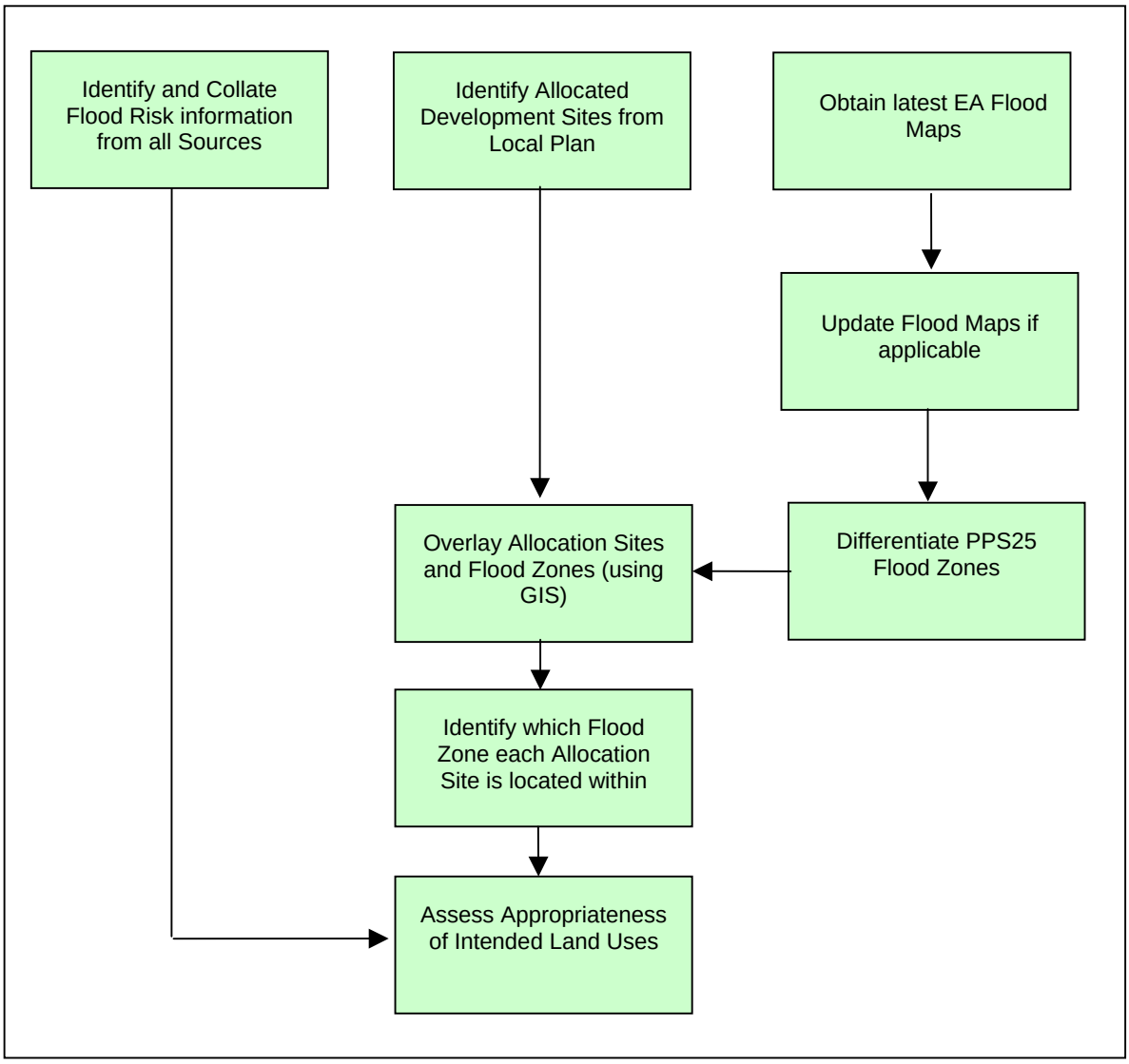


Figure 1: The Sequential Approach Adopted for the SFRA

This section discusses the data collection stages of the SFRA and documents the data sources and the data that was made available to the SFRA.

3.2 Definition of Terms

At this point in the report it will be beneficial to define the terms used to describe the different types of mapping data:

- **Flood Map.** This refers to published map data supplied by the Environment Agency that defines the areas susceptible to inundation from fluvial and tidal flooding events with given annual probabilities.
- **Flood Zones.** These are the areas defined by this SFRA report, based on the Flood Map data but also including other relevant flood data (such as recent hydraulic modelling, fluvial mapping and historical flooding), if available. Any additional data would have to be approved by the Environment Agency

3.3 Overview of the Knowsley District Area

3.3.1 Knowsley Catchment Characteristics

The Borough of Knowsley covers an area of around 86km^2. The area is about 50% urban, with the remaining rural areas of various agricultural quality. Current estimates put the population at about 150,000.

The Borough contains the River Alt and Prescot, Netherley and Ditton Brooks. The Alt drains the north west of the Borough. Prescot Brook drains Prescot, Whiston and parts of the Huyton urban areas. Netherley, Dog Clog, Fox's Bank and Ditton Brooks drain the rural southern parts of the Borough.

3.3.2 Knowsley Geology

The Knowsley area is underlain predominantly by Triassic sandstone and mudstone. There are, however, some areas of Upper Westphalian and Westphalian. Overlying drift geology consists mainly of sand and other course sediments, with some areas of composite solid rock. This information is presented in Appendix E.

3.3.3 Knowsley Groundwater

Groundwater level maps have been provided, with groundwater levels indicated in metres Above Ordnance Datum. This information is presented in Appendix E.

3.4 Overview of the Sefton District Area

3.4.1 Sefton Catchment Characteristics

Sefton Borough covers an area of around 150km^2 with a population of just over 280,000 people (2001 census). Around half the Borough is green belt, with the other half being urban. Much of the agricultural land available is defined as being of high quality, and the Sefton Coast comprises nature sites of international importance.

The Borough of Sefton is largely contained within the Alt and Crossens catchments, with the southern sector falling within the Mersey Estuary catchment. Maghull is drained by Whinney Brook, whilst Netherton Brook drains the south west corner of the Borough. The areas of Formby, Ainsdale and Southport are, with the exception of a small area of Southport, drained by a network of drainage ditches and ordinary watercourses. A small area of north east Southport is drained by the Three Pools Waterway, one of the main arterial watercourses within the Crossens catchment. The Leeds and Liverpool Canal also passes through both catchments within the Borough.

3.4.2 Sefton Geology

The Sefton area consists predominantly of Lower Westphalian and Triassic sandstone. Overlying drift geology consists mainly of Sand, Clay and Silt. This information is presented in Appendix E.

3.4.3 Sefton Groundwater

Groundwater level maps have been provided, with groundwater levels indicated in metres Above Ordnance Datum. This information is presented in Appendix E.

3.5 Knowsley Flood Risk Sources

3.5.1 Fluvial

Fluvial flooding defines flood risk that occurs as a result of out of bank flow of water from overland, natural, watercourses.

The primary source of flood risk in Knowsley is fluvial flooding. The areas identified at risk of fluvial flooding from Environment Agency Flood Maps are those bordering:

- The River Alt
- Knowsley Brook
- Croxteth Brook
- Kirkby Brook
- Court Hey Brook
- Logwood Mill Brook

Knowsley is vulnerable from these watercourses independently and, in wider flood events, concurrently.

The River Alt is the primary watercourse flowing through the north of the Knowsley area and is fed by the smaller tributaries.

Appendix B delineates fluvial flood risk across the Knowsley Metropolitan Borough area. The Council's area falls within two river catchments; the Alt catchment, in which the River Alt flows northwards into Sefton; and the Mersey catchment, where Ditton Brook and its tributaries flow southwards across the Council's boundary towards the River Mersey.

Fluvial flood risk is prevalent at a number of locations:

- The northern fringes of Kirkby and Tower Hill and through Kirkby town centre from Kirkby Brook.
- South of Kirkby, along Knowsley Brook, Croxteth Brook and the confluence of both with the River Alt, a rural area bordering the M57 is identified to be at fluvial flood risk;
- Within the upper, northern reaches of the River Alt, at Woolfall Heath and Fincham; and
- The tributaries within the Mersey catchment i.e. Prescott Brook, Logwood Mill Brook, Fox's Brook, Ochre Brook, Dog Clogg Brook, Mill Brook, Netherley Brook and Ditton Brook form the majority of fluvial flood risk to the central and southern parts of the Council's area.

The flood risk areas along these tributaries predominantly affect rural areas within the Council's boundaries. The exceptions to this are the areas along Prescot Brook and Logwood Mill Brook which run southward through Huyton Business Park.

3.5.2 Surface Water Drainage

Surface water flooding as a result of sewer infrastructure blockage, failure or insufficient capacity, groundwater, pluvial and overland flow all have the potential to contribute significant flood risk in urban areas. This is due to the rapid run-off rates associated with urban land use and the

subsequent volumes of water flowing through infrastructure and overland in relatively short periods of time.

The sewerage undertaker for Knowsley Borough, United Utilities, holds records of flooding issues relating to surface and foul water sewers in a record system called the DG5 register. This register, records the number of properties reported to have been affected by flooding either internally, or externally. It does not however, record the number of properties considered to be at risk from external or internal flooding. United Utilities have been consulted during the development of the SFRA and the DG5 register shows that sewer flooding has been reported in Knowsley, Stockbridge, Longview, Huyton-with-Roby, Whiston and a small area of Tower Hill. More detailed information was unavailable from United Utilities for the purpose of the SFRA.

In addition to the United Utilities database, Knowsley Metropolitan Borough Council maintains a register of reported surface water flooding incidents within the Borough. The surface water flooding incidents are predominantly associated with highway flooding and are prevalent in all major conurbations within the Council's boundaries i.e. Halewood, Cronton, Huyton, Prescot, Knowsley Village, Kirkby, Tower Hill and eastern areas of Fazakerley. This information is presented in Appendix D.

The surface water information gathered can be used to identify areas that have historically been affected by flood incidents.

3.5.3 Groundwater

The DEFRA Groundwater Flooding Scoping Study Report and Groundwater Emergence Maps (GEM) identify areas where ground water is rising and may therefore lead to an increase in flood risk. In the Mersey catchment, this area corresponds with the major aquifers within the Triassic Sandstone.

The GEM identifies areas where, in exceptionally wet winters, groundwater could be at or close to the ground level. Significant areas of the Ditton Brook sub catchment are shown on the GEM, with projected significant rises in groundwater. These areas correspond to the urban area of Huyton. This may change over time as the water table is subject to movement trends and therefore the map in Appendix E is only representative of the current understanding of present day risk.

Consideration should be given to groundwater rise within site specific Flood Risk Assessments to identify the potential impact and mitigation measure suitable for managing the likelihood and impact. Based upon information available during the preparation of this SFRA, it is concluded that groundwater flooding is not a significant and current risk.

3.5.4 Other Water Bodies

Residual risk from canal, reservoir breach, water mains and other infrastructure failures in the Council's area remains a risk to both property and life. The zoning and delineation of this risk area is beyond the scope of this strategic assessment. Identification of these areas at risk is a complex assessment due to the site specific nature of such an occurrence.

Site specific Flood Risk Assessments should identify any known flood risk from these sources and developers and development proposals should provide flood mitigation and flood management measure as part of the design proposals and reduce the flood risk were appropriate.

3.5.5 Historical Flood Events

[Subject to final confirmation].

3.6 Sefton Flood Risk Sources

3.6.1 Fluvial

Fluvial flooding defines flood risk that occurs as a result of out of bank flow of water from overland, natural, watercourses.

The primary source of flood risk in Sefton is fluvial flooding. The areas identified at risk of fluvial flooding from Environment Agency flood maps are those bordering:

- Three Pools Waterway
- The Pool
- Fine Jane's Brook
- Downholland Brook
- River Alt
- Dover's Brook

In addition to the watercourses identified to be at risk by the Environment Agency Flood Map, Sefton Council have expressed concerns regarding the following watercourses: Whinney Brook, Bechers Brook, Dobbs Gutter, Hunts Brook, Larkhill Lane Ditch Maghull Brook and The Pool. The Council have also expressed concerns regarding flood risk to Andrews Lane, Bull Cop, Cable Street, Eight Acre Lane and Hoggs Hill Lane in Formby as well as the playing fields of the King George V College in Southport.

Appendix B delineates fluvial flood risk across the Sefton Borough area as shown on the Environment Agency Flood Map. The river centreline table used on these maps was provided by the Environment Agency and represents watercourses designated as Main Rivers only.

3.6.2 Surface Water Drainage

Surface water flooding as a result of sewer blockages, failure or insufficient capacity has the potential to contribute significant flood risk in urban areas, as does that from water flowing over the surface on

its way to a drain/watercourse. This is due to the rapid run-off rates associated with urban land use and the volume of water that flows into the sewer systems in relatively short periods of time.

The sewerage infrastructure of the urban parts of the Borough of Sefton is largely based on Victorian sewers and there is a risk of localised flooding associated with the existing public sewerage system. The drainage system may be under capacity and/or subject to blockages resulting in localised flooding of roads and property. United Utilities is responsible for the management of the public sewerage system throughout the borough, including surface water, foul and combined sewerage.

United Utilities, holds records of flooding issues relating to surface and foul water sewers in a register that forms the Director General of OFWAT's Report on Issue Number 5 (DG5 Register). This register, records the number of properties affected by flooding both internally, and externally. It does not, however, record the number of properties considered to be at risk from external or internal flooding. Appendix D contains maps of the DG5 data. The category boundaries shown in Appendix D were chosen after an analysis of the flooding frequency indicated in these areas. These categories indicate the differences between those areas having a low frequency of flooding, whilst also flagging up those areas with the highest frequency.

United Utilities has been consulted during this SFRA and the sewer flooding DG5 register shows that sewer flooding is an issue in Aintree, Bootle, Litherland, Orrell, Crosby, Thornton, Maghull, Formby, Ainsdale and Southport. It must be noted that the DG5 register is not a register of properties at risk of flooding, it is a list of properties that have been reported to have flooded, due to hydraulic inadequacy, insufficient capacity or failure of the public sewerage system. More detailed information from United Utilities, for the purpose of the SFRA, has not been made available.

An additional dataset provided by the Council identifies a number of urban locations around Sefton which have experienced surface water flooding in the past.

The Rimrose Valley watercourse is predominantly culverted and forms a public sewer, which drains south east Crosby. The culverts draining into Rimrose Valley watercourse experience blockage and cause flooding, this is likely to be due to poor maintenance by riparian owners. In central Southport, the Nile watercourse has all but disappeared. As developments took place, it has either been filled in, piped or integrated into the existing drainage and sewerage system. It is believed that water still collects and may follow the former route of the Nile; this may pose some surface water flood risk to property. In Maghull there is also a flood risk issue caused by undersized culverts through back gardens in the area around Sefton Lane and Liverpool Road South. There is further flood risk associated with culverts in the area of Little Altcar and Marshside, Southport.

Surface water flooding is likely to be high in frequency (occurring on an annual basis) with the potential to cause significant local impact. Sefton Council has provided specific data sets detailing surface water flooding issues and these are discussed below.

Council Datasets

Sefton Council has reported that land drainage and surface water flood risk concerns have been raised by the local community and local councillors alike in Formby. The development of the Core Strategy has shown flood risk to be one of the most important concerns for Formby. An ongoing Formby Drainage Study is due for completion mid 2009 and should provide more detailed information about surface water issues in Formby. A similar study for the Thornton area is programmed for 2011/2012.

Sefton Council provided the following short history of flood risk in Formby:

> "In Formby, the surface water system grew around the existing open channel network in the [formerly] largely agricultural area. The resultant drainage system comprises a series of small sub-catchments linked by ditches and watercourses. As Formby developed, the more minor channels where either culverted, laid with land drains and backfilled, or simply filled in. These have all led to a reduction in the efficiency of the original land drainage system, and frequent reports of flooding to the Council.

> Ultimately, all of Formby's surface water drains via the ditches and watercourses (many of which are riparian) to the River Alt, either directly or via its tributary Downholland Brook to the east of Formby. However, the high level of the ground water table during wet conditions can result in high water levels in these ditches and watercourses, which prevents the sub-catchments from discharging surface water effectively. Additionally, high levels in the River Alt also prevent the ditches and watercourses from discharging into the river"

Appendix D includes all available geo-referenced information on surface water issues in the Sefton area. These locations, and notably the red circles representing 'surface water issues', are indicative only due to the scale of mapping and the generalised address nature of the original data. They represent general areas rather than individual addresses. These locations have been taken from reports and registers provided by Sefton Council including;

- the land drainage flooding correspondence from 2000 to 2007;
- the land drainage list 2006-2007; and
- a geo-referenced list of locations that has experienced surface water issues.

This information is provided in addition to the DG5 register data which has been provided by United Utilities. Historic flood extent outlines for fluvial and tidal events and specific, geo-referenced locations have not been available for this SFRA and, therefore, are not presented on these maps.

3.6.3 Canal Infrastructure

The Leeds and Liverpool Canal runs through Sefton Borough and responsibility for it is held by British Waterways. No information was made available for this SFRA. The risk of flooding from the canal is limited to areas where the canal is elevated above natural ground level. On 1st October 1994 the Leeds and Liverpool canal broke through into the Maghull Brook culvert. This led to a progressive collapse of the culvert allowing the canal to burst its bank. As a result, over 200 properties were flooded.

Canal breaches are rare and, therefore, the risk has a relatively low significance. The location of potential breaches is difficult to predict and could occur anywhere the canal is above the surrounding land level. Were a breach to occur between Liverpool docks and Appley Locks (a distance of 27 miles), the extent of flooding could potentially be significant, as there are no locks to automatically control the flow through a breach along this length.

3.6.4 Tidal

Sefton Borough Council's Coastal Defence team were consulted regarding the potential impact of tidal flooding. The tidal areas of Sefton are covered by two separate Shoreline Management Plans (SMPs), including the tidal limits of the Mersey Estuary as far south and east as Warrington. Sefton Council's coastal defence team are currently reviewing and revising the Shoreline Management Plans (SMPs) produced in 1999.

The Environment Agency Flood Map, refer to Appendix B, indicates those areas at risk from tidal flooding. In the Sefton area, this includes the Southport seafront, Marshside, an area to the east of Meol's Hall and the low lying area at the confluence of the River Alt and Downholland Brook.

Tidal flood risk to the Sefton shoreline can be split into the risks from overtopping and from breach. Overtopping is a risk at Southport and Crosby, which is defended by coastal defences to a 20 year standard of protection. Under DEFRA climate change scenarios for the north west of England, sea level rise may increase the risk of overtopping to these areas even further, particularly around Crosby swimming baths and Hall Road West, Crosby. The coastal reach between these two areas is protected by soft defences in the form of retreating sand dunes. Current indications are that the coast at Hightown is likely to erode to the point where parts of the village may be lost to the sea and, under current climatic change scenarios, flooding may be more prevalent, unless coastal protection works are undertaken.

Current advice from the Sefton Council's coastal defence team for areas of new development in the Seafront area of Southport is to have a floor slab level of at least 6.5m AOD. This is above the current level to which existing defences offer protection, but below potential sea levels predicted by climate change scenarios over the next 100 years.

Defences to the north of Southport, including the seawall north of Fairway, are considered to be more at risk of breach due to their age. Given this risk, secondary defences, notably the former sea embankment north of Hesketh Road, are maintained in case of future need to realign the primary defence.

Sefton have undertaken a large amount of work to model, understand and map the effects of coastal erosion along their coastline. This indicates there are some areas where erosion is likely to dominate, potentially changing the flood risk at areas where natural features (such as dunes and beaches) form part of the natural defences. Where erosion occurs, this is likely to decrease the standard of defence offered at these points and therefore increase flood risk. The risk potentially posed is explained further in Section 4.1.3.

3.6.5 Groundwater

The groundwater contours shown in Appendix E, and indicated in Appendix J, relate to underlying ground water levels. It is known that perched ground water levels occur closer to ground level where soak-aways and existing land drainage are utilised for the removal of surface water. This is evident by the increase in reports of flooding particularly in Maghull, Aintree and including water damage to road sub-base due to high ground water levels in the Formby area.

Groundwater flooding issues have been identified in Maghull, central Bootle, the Rimrose Valley in Crosby and eastern Southport, Appendix J contains a map of the groundwater risk areas. This may change over time as the water table is subject to movement trends and therefore the map is only representative of the current understanding of present day risk.

Other than the groundwater flooding issues at Maghull, there are no other areas that have been identified as having experienced groundwater flooding in the past. The groundwater contours provided (Appendix E) indicate there may be potential issues at Lydiate and north Crosby along the 10m contour and also at Aintree. This may change over time as the water table is subject to movement trends and, therefore, future groundwater affected areas can not be identified at this stage.

There is an additional aquifer under the coastal dunes. Coastal modelling has indicated that these dunes are likely to retreat as they are eroded. This will change the size and location of the aquifer and any areas which are currently affected by it.

3.6.6 Historical Flood Events

Harrogate Way, Southport, experienced tidal flooding in November 1977 when a combination of severe storms and high tides resulted in water levels overtopping the defence on the Three Pools Watercourse; no further information is available regarding this defence. 110 houses were flooded to a depth of around 1m, although there were no injuries or loss of life.

The Thornton area experienced pluvial flooding in January 2008 which has been attributed to riparian owners not correctly maintaining their sections of watercourse. The "Watercourse Maintenance and Flooding in Sefton" report to the Scrutiny and Review Committee (Regeneration and Environmental Services) in February 2008, indicates a number of areas where highway and property flooding had occurred in the three years leading up to the report. Responsibilities for the flooding were considered as being split (in various cases) between United Utilities, Sefton Council and riparian owners, with the cause frequently being either land drainage or culvert capacity issues.

Information on historic surface water flooding has been presented in Section 3.5.2.

3.7 Knowsley Flood Risk Information

Section 3.4 identified the sources of flood risk, historic occurrences and identified areas considered to be at risk of flooding in the future. This section explains the information that is available to define the Flood Zones, in accordance with PPS25, for use in subsequent sequential testing.

The Environment Agency published Flood Map was the primary source of information to define the Flood Zones with some contribution from the CFMP for Functional Floodplain definition. Additional modelling was not undertaken as part of this SFRA to update the Flood Zone Maps. Upon approval of recent and future flood mapping study outputs, the defined Flood Zones for this SFRA should be revisited and updated as necessary in consultation with the Environment Agency.

3.7.1 Environment Agency Flood Map

The Environment Agency's Flood Map was first published on the Internet in October 2004. The Flood Map is the Environment Agency's current best estimate of the undefended flood outline for a range of probabilities of event. Flood Map 3 shows the 1% Annual Exceedance Probability (AEP) (100 year) fluvial event and the 0.5% AEP (200 year) tidal event. Flood Map 2 shows the 0.1% AEP (1000 year) fluvial and tidal floodplain. Flood Map 1 is the area outside the Flood Map 2 outline, i.e. areas with less than a 0.1% AEP (greater than a 1000 year) event.

The Flood Map outlines have been derived using a combination of a generalised model derived as part of the Flood Zone Project (a high level national mapping programme) with more detailed hydraulic modelling and historical flooding outlines. The Flood Map outlines, therefore, have a varying degree of accuracy dependent on the quality of the inputs and, in particular, the availability of detailed hydraulic modelling. The online Flood Map is updated on a quarterly basis as the Environment Agency's knowledge of flooding is improved through detailed modelling studies, recent flood events and data from river level and flow monitoring stations. The Environment Agency Flood Maps within the Alt Crossens catchments are represented by flood risk mapping undertaken under the Strategic Flood Risk Mapping (SFRM) contract and the previous Section 105 Agreement[6].

Climate change scenarios are not available on the Environment Agency website.

The Environment Agency Flood Map 3 presents indicative flood risk outlines for the fluvial 1% Annual Exceedance Probability (AEP) (100 year event) combined with the tidal 0.5% AEP (200 year event), and Flood Map 2 presents the 0.1% AEP (1000 year event).

Flood map 2 and 3 contribute to the definition of the PPS25 Flood Zones. It is important at this point to state clearly that the Environment Agency Flood Maps and the PPS25 Flood Zones are two separate sets of flood risk outlines.

The Flood Zones are described in Section 6.4 of this report at which point the PPS25 Sequential Test approach is introduced. To aid understanding at this stage, the following table illustrates how the Environment Agency Flood Maps are used to help define the PPS25 Flood Zones.

Flood Probability	Environment Agency Flood Map	PPS25 Flood Zone
<0.1% AEP	Flood Map 1	Flood Zone 1
0.1% AEP	Flood Map 2	Flood Zone 2
1% AEP	Flood Map 3	Flood Zone 3a
4% or 5% AEP	Outline from Alt Crossens CFMP study showing a 4% AEP	Flood Zone 3b 'Functional Floodplain'

Table 3.1: Environment Agency data used in the definition of PPS25 Flood Zones

[6] The Section 105 Agreement delivers the requirements of Section 105 of the Water Resources Act, 1991, as detailed in Circular 30/92.

3.7.2 Hydraulic Modelling

A number of flood risk mapping studies have been carried out by the Environment Agency across Knowsley Borough. These studies have involved the development of detailed hydraulic models, providing a more robust understanding of the local flooding mechanisms and flow paths which are used to continually improve understanding of flood risk and to steer future flood risk management investments.

The detail of these studies varies depending upon the intended end use of the hydraulic model information. The Alt flood risk mapping study undertaken on behalf of the Environment Agency was carried out in accordance with Section 105 of the Water Resources Act and provides a level of detail of sufficient accuracy considered appropriate for the SFRA. Section 105 projects were commissioned following the introduction of Planning Policy Guideline 25 which required local authorities to manage future development (and redevelopment) in an effective and sustainable manner so as to ensure that the risk posed by flooding to future occupiers and/or neighbouring properties was minimised.

The modelling undertaken for the Alt Crossens CFMP was specifically developed to support the broad scale, catchment wide study and has not yet been reviewed by the Environment Agency. Therefore, the outlines produced as part of the CFMP have not been used to help refine the existing Flood Maps which in turn help define the Flood Zones used in the PPS25 Sequential Test. However, the 4% AEP (25 year event) flood outlines developed for the CFMP have been used to represent Flood Zone 3b, the Functional Floodplain, within Knowsley because no other information was available. The Environment Agency have agreed that this approach is appropriate.

Through consultation with the Environment Agency, it was found that hydraulic modelling studies have been undertaken on the following watercourses within the Knowsley area:

- River Alt
- Croxteth Brook
- Knowsley Brook
- Fazakerley Brook
- Ditton Brook
- Whittle Brook

The hydraulic modelling is based on detailed cross-sectional survey and hydrological assessment, and the mapping of the flood levels is based on detailed Digital Terrain Model data provided by LiDAR aerial survey. Therefore, the flood extents derived from the detailed hydraulic modelling are considered to be more accurate than the original Flood Map which is derived from a National Generalised Model which cannot fully represent complexities in flood flow routes. The Environment Agency Flood Maps are discussed further in Section 3.7.1.

Other areas of flood risk mapping have been produced using less accurate modelling techniques and scales.

3.7.3 Recent and Ongoing Studies on Flood Risk

Catchment Flood Risk Management Plans (CFMPs) have recently been completed for both the Mersey Estuary and the Alt Crossens catchments by the Environment Agency. The aim of the CFMP is to identify flood risk management policies which will reduce flood risk to people and the built environment; maximise opportunities to work with the natural environment; contribute towards sustainable development and sustainable flood management practice; support implementation of EU directive and Government policies and targets; and support planning policies statutory land use plans and the implementation of the Water Framework Directive. The CFMP documents give an overview of the flood risk in the Mersey Estuary and Alt Crossens catchments and set out a preferred plan for sustainable flood risk management over the next 50 – 100 years. The delivery of sustainable flood risk management in line with the CFMP policies will rely on partnership working between the Environment Agency, Local Planning Authorities, water companies and a wider group of organisations involved with the management and use of land within the catchments.

Figure 2 below shows the Knowsley and Sefton Borough boundaries and the Mersey and the Alt Crossens CFMP boundaries. As can be seen, Knowsley contains the Liverpool units of the Alt Crossens and Mersey Estuary CFMPs, as well as the Knowsley and Upper & Middle Sankey of the Mersey Estuary CFMP. The Widnes and St Helens policy units of the Mersey Estuary CFMP cover limited areas of the Knowsley Borough.

The policies selected for the relevant policy units in the two CFMPs are as follows:

- The Liverpool policy unit (for the Alt Crossens CFMP and affecting both Knowsley and Sefton Boroughs) policy was assessed as “Take further action to sustain the current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change, and climate change)”.
- The Knowsley policy was “to reduce existing flood risk management actions (accepting that flood risk will increase over time)”. The policy selected for the Upper & Middle Sankey unit was to “Take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits, locally or elsewhere in the catchment”.

The Logwood Mill Brook Flood Risk Mapping Study, is currently being prepared by the Environment Agency, and will be finished in 2009. This study in conjunction with the CFMP, will contribute to the understanding of flood risk within Knowsley.

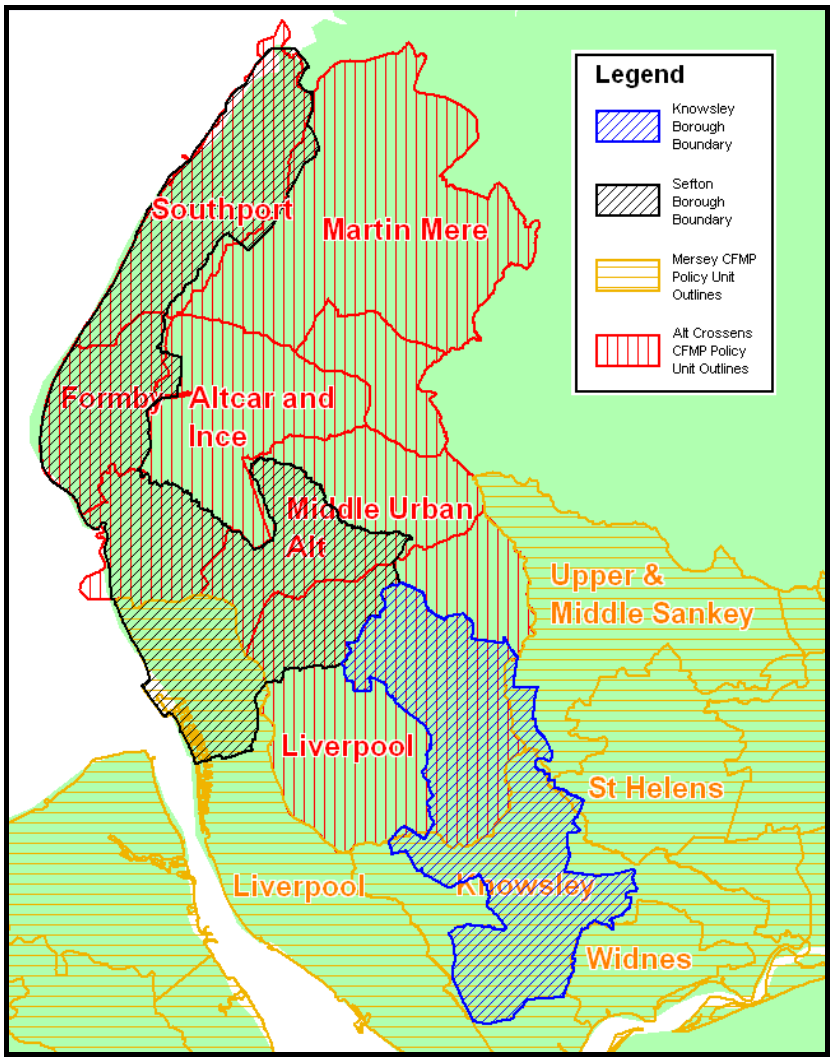


Figure 2: CFMP policy unit areas and Borough boundaries

3.8 Sefton Flood Risk Information

Section 3.5 identified the sources of flood risk, historic occurrences and identified areas considered to be at risk of flood risk in the future. This section explains the information that is available to define the Flood Zones, in accordance with PPS25, for use in subsequent sequential testing.

The Environment Agency published Flood Map was the primary source of information to define the Flood Zones, with some contribution from the CFMP for Functional Floodplain definition. Additional modelling was not undertaken as part of this SFRA to update the Flood Zone Maps. Upon approval of recent and future flood mapping study outputs, the defined Flood Zones for this SFRA should be revisited and updated, as necessary, in consultation with the Environment Agency.

3.8.1 Environment Agency Flood Map

The Environment Agency's Flood Map was first published on the Internet in October 2004. The Flood Map is the Environment Agency's current best estimate of; the undefended 1% annual exceedance probability (AEP) (100 year event) and 0.1% AEP (1000 year event) fluvial floodplain; and the undefended 0.5% AEP (200 year event) and 0.1% AEP (1000 year event) tidal floodplain. Flood Maps are contained within Appendix B.

The Flood Map outlines have been derived using a combination of a generalised model created as part of the Flood Zone Project (a high level national mapping programme) with more detailed hydraulic modelling and historical flooding outlines. The Flood Map outlines, therefore, have a varying degree of accuracy dependent on the quality of the inputs and, in particular, the availability of detailed hydraulic modelling. The online Flood Map is updated on a quarterly basis as the Environment Agency's knowledge of flooding is improved through detailed modelling studies, recent flood events and data from river level and flow monitoring stations. The Environment Agency Flood Maps within the Alt Crossens catchments are represented by flood risk mapping undertaken under the Strategic Flood Risk Mapping Study (SFRM) contract and the previous Section 105[7] Agreement.

Climate change scenarios are not available on the Environment Agency website.

The Environment Agency Flood Map 3 presents indicative flood risk outlines for the fluvial 1% Annual Exceedance Probability (AEP) (100 year event) combined with the tidal 0.5% AEP (200 year event), and Flood Map 2 presents the 0.1% AEP (1000 year event).

Flood Map 2 and 3 contribute to the definition of the PPS25 Flood Zones. It is important at this point to state clearly that the Environment Agency Flood Maps and the PPS25 Flood Zones are two separate sets of flood risk outlines.

The Flood Zones are described in Section 6.4 of this report at which point the PPS25 Sequential Test approach is introduced. To aid understanding at this stage, the following table illustrates how the Environment Agency Flood Maps are used to help define the PPS25 Flood Zones.

Flood Probability	Environment Agency Flood Map	PPS25 Flood Zone
<0.1% AEP	Flood Map 1	Flood Zone 1
0.1% AEP	Flood Map 2	Flood Zone 2
1% AEP	Flood Map 3	Flood Zone 3a
4% or 5% AEP	Outline from Alt Crossens CFMP study showing a 4% AEP	Flood Zone 3b 'Functional Floodplain'

Table 3.2: Environment Agency data used in the definition of PPS25 Flood Zones

[7] The Section 105 Agreement delivers the requirements of Section 105 of the Water Resources Act , 1991, as detailed in Circular 30/92.

3.8.2 Hydraulic Modelling

A number of flood risk mapping studies have been carried out by the Environment Agency across the Sefton Borough. These studies have involved the development of detailed hydraulic models, providing a more robust understanding of the local flooding mechanisms and flow paths which are used to continually improve understanding of flood risk and to steer future flood risk management investments.

The detail of these studies varies depending upon the intended end use of the hydraulic model information. Section 105 modelling was originally conducted for the Alt catchment and this was followed by a Strategic Flood Risk Mapping (SFRM) project. Outlines from both the Section 105 and SFRM mapping projects have been combined to produce the Environment Agency's Flood Maps, which are used as the basis for Flood Zones 2 and 3a in this study (shown in Appendix F).

The modelling undertaken for the Alt Crossens CFMP was specifically developed to support the broad scale, catchment wide study and has not yet been reviewed by the Environment Agency. Therefore, the outlines produced as part of the CFMP have not been used to help refine the existing Flood Maps which in turn help define the Flood Zones used in the PPS25 Sequential Test. However, the 4% AEP (25 year event) Flood Map outlines developed for the CFMP have been used to represent Flood Zone 3b, the Functional Floodplain, within Sefton because no other information was available. The Environment Agency have agreed that this approach is appropriate.

No watercourses modelled for the Mersey Estuary CFMP fall in the Sefton area.

Watercourses for which hydraulic modelling has been undertaken in Sefton, during the completion of the River Alt Section 105 and the Alt Crossens CFMP, include the following:

- River Alt
- Dover's Brook
- Downholland Brook
- Wham Dyke
- Fine Jane's Brook
- Boundary Brook

The hydraulic modelling is based on cross-sectional survey data and hydrological assessment, and the mapping of the flood levels in non 2D modelling areas is based on detailed Digital Terrain Model data provided by LiDAR aerial survey. The Environment Agency Flood Maps were discussed further in Section 3.8.1 and are provided within Appendix B.

Watercourses passing through the centre of Maghull, such as Whinney Brook, were not modelled as part of the CFMP.

Other areas of flood risk mapping have been produced using less accurate modelling techniques and scales.

Tidal modelling has also been undertaken to analyse tidal flood risk. This information has been included in the Shoreline Management Plans affecting the Sefton coastline. These are the Liverpool Bay SMP (sub cell 11a) and Ribble Estuary SMP (sub cell 11b). At the time of writing these Shoreline Management Plans were under revision. Other studies with relevance to flood risk have been undertaken or are currently being completed. A Strategy Study is currently being finalised for the coastal area from Crosby Marine Lake to Formby Point, setting out detailed policies for this length of coast for the next hundred years. Reference to this study should be made when considering any development in this area.

3.8.3 Recent and Ongoing Studies on Flood Risk

The Alt Crossens and Mersey Estuary Catchment Flood Management Plans (CFMPs) are completed and are currently available for consultation. These CFMPs set out the delivery of flood risk management into the medium and long term future. A number of recommendations have been made for the different policy units that they contain. Figure 2 shows the locations of the Knowsley and Sefton Boundaries and the policy units used in the two CFMPs.

The Borough of Sefton is covered by policy units Liverpool, Middle Urban Alt, Altcar and Ince, Formby, Martin Mere (although this covers very little of the Borough) and Southport of the Alt Crossens CFMP, and the Liverpool policy unit of the Mersey Estuary CFMP.

In the Alt Crossens CFMP, the following policies are selected for relevant policy areas:

- The Liverpool policy unit (also affecting Knowsley Borough), Formby, and Southport units have been allocated the policy "take further action to sustain the current level of flood risk into the future (responding to the potential increases in risk from urban development, land use change and climate change)".
- The Middle Urban Alt, and Martin Mere policy units were allocated the policy of "continue with existing or alternative actions to manage flood risk at the current level".
- The Altcar and Ince policy unit was allocated the policy "take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits. Locally or elsewhere in the catchment".

The policy selected for the Liverpool policy unit of the Mersey Estuary CFMP was:

- "Take further action to sustain the current scale of flood risk into the future (responding to the potential increases in flood risk from urban development, land use change, and climate change)".

The Environment Agency is currently undertaking the Lower Alt Project Appraisal Report (PAR) and Alt and Crossens combined strategy studies. When information becomes available from these studies, future updates of the SFRA should make reference to these studies. These studies in conjunction with the CFMP, will contribute to the understanding of flood risk within Sefton.

The Sefton coastline falls within 2 discrete sub-cells, each Sub cell has its own Shoreline Management Plan (SMP). The policies set out in each of the SMP's were incorporated in Sefton's Coastal Defence Issues and Strategy document which takes account of both Plans findings and recommendations. This document is a comprehensive coastal defence strategy. Strong attention has been paid to the role the natural dune system plays in coastal defence. This includes how effective management will complement the role of artificial defence systems along the Coastline and the fundamental importance they have in protecting large areas of the Sefton Coastline. Other studies with relevance to flood risk have been undertaken or are currently being completed. A Strategy Study is currently being finalised for the coastal area from Crosby Marine Lake to Formby Point, setting out detailed policies for this length of coast for the next hundred years. Reference to this study should be made when considering any development in this area.

3.9 Knowsley Existing Flood Defences

3.9.1 Environment Agency Flood Defences

Information on flood defences is required to indicate areas where there is protection from fluvial flood risk, the level of protection provided by the defence, as well as its predicted life.

Flood defences are raised structures which prevent floodwater from inundating surrounding areas either by altering the natural flood flow paths from a watercourse or by retaining flood water. Flood defences are categorised as 'formal' defences or 'informal' defences. A 'formal' defence is a structure that was built specifically to defend land or property from flooding and is maintained for this purpose by the Environment Agency, Local Authority, or a riparian landowner. An 'informal' defence is a structure that has not been specifically built to retain floodwater and is not maintained for this specific purpose but may afford some protection against flooding. 'Informal' defences include boundary walls, industrial buildings, railway line and road embankments.

The extent, condition and standard of protection of the defences owned and maintained by the Environment Agency are recorded within the National Flood and Coastal Defence Database (NFCDD). A full table of defence information extracted from the NFCDD is given in Appendix L, detailing the location of defences and the standard of protection provided.

There are formal flood defences along the River Alt in the form of raised linear embankments. Although NFCDD defence data obtained from the Environment Agency suggests these structures provide less than a 1% AEP (100 year event) defence provision.

Appendix L lists the raised defences contained on the Environment Agency NFCDD in conjunction with those identified by Knowsley Council.

3.9.2 Culverts

Data collected for the purpose of the SFRA has identified several culverted sections of watercourses along the tributaries of Ditton Brook and the River Alt. However, without further detailed information regarding these culverts, assessment of the impacts of these culverted watercourses to flow regimes, and subsequent flood risk, is not possible. Development within areas surrounding culverted watercourses, particularly the inlet of structures, should consider the risk associated with blockage and performance issues. A list of culverts contained in the NFCDD for the Knowsley area is given in Appendix L.

3.9.3 Flood Warning

There are no Flood Warning areas in the Knowsley area.

3.10 Sefton Existing Flood Defences

3.10.1 Review of Existing Defences

Both fluvial and tidal defences exist in the Sefton Borough area. The locations and extents of these are provided in Appendix C.

There are hard defences of different types at both Southport and Crosby. These provide a 5% AEP (20 year event) design standard, and experience limited overtopping during a 4% AEP (25 year) event. The most recent coastal defence inspection report, available on the Sefton Council's website, is from 2006 and indicates that some areas of the defence network require immediate or short term remedial action, however most stretches are in acceptable condition.

Most of the remaining defences contained in the Sefton area are, according to the National Flood and Coastal Defence Database (NFCDD), designed to a 2% AEP (50 year event) standard. Some areas have defences stated as being to a higher 1.4% AEP (70 year event) standard, although some areas have a lower 4% AEP (25 year event) standard.

The extent, condition and standard of protection of the defences owned and maintained by the Environment Agency are recorded within the NFCDD. A full table of defence information extracted from the NFCDD is given in Appendix L, detailing the location and design standard of the defences.

There are two main Areas Benefitting from Defences (ABDs) in the Borough of Sefton. Only areas benefiting from a 1% AEP (100 year event) standard of protection are identified, in accordance with Environment Agency guidance for ABDs. The first of these is to the south of Formby, around the River Alt/Downholland Brook confluence and most of this area is shown as being rural. The other area benefiting from defences is to the north of Southport, including parts of the seafront which are not built up, as well as a large area of Marshside and Crossens.

3.10.2 Flood Defence Structures

Flood Defence Assets

Within the Borough of Sefton there are some key flood defence assets which are not linear, raised defences. The two main defences of this type are Altmouth pumping station and Crossens pumping station, two of the largest pumping stations in Europe. These pumping stations are managed by the Environment Agency and further information is available in the Alt Crossens Catchment Flood Management Plan.

The Altmouth pumping station is currently awaiting a major refurbishment, which will alter the number and type of pumps contained in the station, but will continue to provide the existing standard of protection. Crossens pumping station located at Banks, to the north of Southport, is fed by three

main gravity drained channels with numerous minor tributary drains at lower levels served by satellite pumping stations.

Sefton Council owns or maintains pumping stations at Broad Lane, Lunt, and Sefton Meadows, both of which pump surface water to the River Alt. The Broad Lane station serves a mainly agricultural area, the Sefton Meadows station serves an area including some rural land and commercial and residential areas in the west of Maghull.

Information regarding the height of defences was not available within the NFCDD.

Raised Formal Defences
According to the Environment Agency's NFCDD, there are a number of formal raised defences in the Borough of Sefton, which have a standard of protection of between 4% and 2% AEP (between 25 and 50 year events). There are many watercourses which have Environment Agency maintained channels. A section of The River Alt at the M57 and M58 junction is protected to a 1.4% AEP (70 year event) standard. Downstream of Downholland Brook, defences are generally to a design standard of 2% AEP (50 year event). There is no defined standard of protection for some of the defences around the Altmouth area. All other defences are stated as being of a 2% AEP (50 year event) standard.

Appendix L lists the raised defences contained on the Environment Agency NFCDD.

Informal Raised Defences
There are a large number of privately maintained informal defences within the Borough. These defences include man-made, formal structures such as walls that provide some form of flood defence and man-made topographic features such as earth embankments. Without extensive ground investigations and data collection, specific details of these defences will remain unknown. These informal defences are not included in NFCDD and are not included in Appendices C or L.

Culverts
No major culverts controlling flow are identified in either the Mersey or Alt and Crossens CFMP catchments. However, many minor culverts are identified by the NFCDD dataset as being liable to increase flood risk when they become blocked. These include a number of culverts in the Maghull area, mainly under major roads, several culverts in the south Formby area, around Little Altcar, and several culverts under the Marshside area of Southport. Surface water flooding issues at these locations have been identified by Sefton Council's drainage team. Additional information was provided by Sefton Council regarding flood risk associated with watercourses, including culverts, and this information has been presented in Section 3.5.1.

Section 3.5.2 details issues related to surface water flooding from culverts and sewers. A list of culverts contained in the NFCDD for the Sefton area is given in Appendix L.

3.10.3 Flood Warning

No fluvial flood warning provision has been identified in the Alt Crossens or Mersey Estuary CFMPs within the Sefton area.

Tidal flood warning is provided for coastal areas from 3 Flood Warning areas: Lancashire tidal breach at Marshside, Merseyside coastline at Southport and Merseyside Coastline at Crosby. The locations of these are shown in Appendix B.

3.11 Proposed and Potential Development Sites

3.11.1 Knowsley

Information on land allocations within the Knowsley Borough has been provided by the Planning Team of Knowsley Borough Council. The sites are identified from the Unitary Development Plan. The analysis undertaken in this SFRA (Appendix I) is based on these sites.

There are 8 housing development sites, 7 action areas and opportunity sites, 36 economic development areas and 8 transport areas planned.

The location of all of these allocated sites are shown on the figures located in Appendix H.

3.11.2 Sefton

Information on land allocations within the adopted Unitary Development Plan and existing Local Development Framework documents within Sefton Borough has been provided by the Planning Team of Sefton Borough Council. The analysis undertaken in this SFRA (Appendix I) is based on these sites.

10 housing sites, 16 industrial sites and two specific retail sites have been identified. In addition, 5 strategic employment sites have been identified, along with 2large development briefs at Klondyke and Queens Bedford. There are also 14 potential transport and 7 other developments. Many of the potential transport sites are small park and ride sites near Mersey Rail stations.

3.12 Consultation

3.12.1 Knowsley and Sefton Borough Councils

The Forward Planning Teams at both Knowsley and Sefton Councils have been consulted in an effort to identify both the areas under pressure from development and the sites which have been allocated for potential development within the adopted Unitary Development Plan and existing Local Development Framework documents.

Sefton's Coastal Defence team and the drainage teams at both Sefton and Knowsley have also been consulted to gain an understanding of local flood risk issues. Information received through this consultation exercise has been included in this SFRA.

3.12.2 Environment Agency

The Boroughs of Knowsley and Sefton lie within the Environment Agency's North West Region's South and Central Areas, which are based at Appleton House in Birchwood, Warrington and at Lutra House, Preston, respectively. The Development Control, Flood Risk Mapping and Data Management teams within the Agency have been consulted to obtain information on sources of flood risk, hydraulic modelling, flood defences and flood warning as well as to discuss future sustainable flood risk management and mitigation measures.

3.12.3 United Utilities

The sewerage infrastructure of the older, urban parts of the Boroughs of Knowsley and Sefton is largely based on Victorian sewers and there is a risk of localised flooding associated with the existing public sewerage system. The drainage system may be under capacity and/or subject to blockages resulting in localised flooding of roads and property. United Utilities is responsible for the management of the public sewerage system throughout the two boroughs, including surface water, foul and combined sewerage.

United Utilities take the issue of surface and foul water flooding very seriously and have invested £52 million over recent years to reduce flooding from these sources in the North West.

United Utilities were consulted to obtain information on the number of recorded incidences of sewer flooding. Information was provided only as a summary of the number of recorded incidents by post code area so it was difficult to pinpoint locations with any known capacity problems or infrastructure at particular risk of failure. This information is shown in Appendix D.

3.12.4 British Waterways

British Waterways have been consulted to obtain information on their assets located on the Leeds Liverpool Canal. Unfortunately they have not been able to provide any information on their assets, and therefore this can not be considered in this SFRA at present. The information was requested because it would help define potential flood risk associated with canal infrastructure.

Future updates of the SFRA should incorporate this information, should it become available.

3.12.5 Merseyside Fire and Rescue Service

Consultation was undertaken with the Fire and Rescue Service to identify locations at which they have been involved in flood incident management in the last 5 years. Unfortunately this information was not available for inclusion in this SFRA. Future updates of the SFRA should incorporate this information, should it become available.

3.12.6 Neighbouring Planning Authorities

Neighbouring planning authorities have been consulted to identify potential upstream developments that could cause increased flood risk within the Knowsley and Sefton Boroughs.

For the purposes of this SFRA only local authorities having land boundaries with fluvial catchments have been considered.

Knowsley is bordered by West Lancashire, St Helens, Halton, Liverpool and Sefton. There is limited watercourse interaction with Halton, Liverpool and St Helens.

Sefton is bordered by West Lancashire, Knowsley and Liverpool. It is recognised that Sefton also has boundaries with Fylde and Wirral but these are formed by the tidal estuaries of the River Ribble and River Mersey respectively and any developments within those boroughs would have no impact on Sefton.

Upstream Authorities

Knowsley and West Lancashire are upstream of the Sefton area. In line with PPS25, any developments in these areas should be designed not to increase flood risk, and therefore should not impact downstream flooding. There is minimal watercourse interaction between the Boroughs of St Helens and Knowsley and therefore any development in St Helens is not likely to increase flood risk in Knowsley. It is unlikely that there is any significant interaction between Liverpool and neighbouring areas, because of the highly urban nature of the catchment.

Downstream Authorities

There are no authorities downstream of Sefton, however Sefton is in the downstream limits of the River Alt catchment of which the Knowsley area forms part. Parts of Sefton Borough lie in the Crossens catchment and due to the low lying, flat nature of this catchment there is the potential for interaction with West Lancashire District Council.

West Lancashire is downstream of Knowsley although the scope for interaction of flood risk is limited, likewise, downstream impacts to St Helens and Halton from development within Knowsley are also considered to be minimal.

4. Analysis

4.1 Flood Risk Sensitivities

Having described the flood risks in Knowsley and Sefton in the previous sections it is necessary to make an assessment of the sensitivity of these risks to climate change and variability associated with developments, particularly urban development.

Altmouth and Crossens pumping stations are physical barriers and the most significant structures in their catchment. The Environment Agency Flood Map (shown in Appendix B) ignores the presence of defences (i.e. assumes no defences) and so the Flood Maps take into account possible breaches of these pumping station defences The impact of failure of these structures was specifically included in the Alt Crossens CFMP, which found that the Environment Agency Flood Map undefended, extents were indeed more extensive than the breach extents. Other defences in the study area have standards of service below the 1% annual probability of flooding level and therefore have limited significance to this SFRA.

Both the Mersey Estuary and Alt Crossens CFMPs have identified that the major cause of increased flood risk in the future will be climate change.

4.1.1 Flood Sensitivity to Climate Change.

As a result of climate change, it is widely expected that winter floods will happen more often and that rainfall events will be of higher intensities (Table B.2, Annex B, PPS25, Dec 2006). Within urban areas, the frequency and severity of flooding from these high intensity events is expected to increase due to limitations of existing surface water drainage systems. However, without the availability of detailed models and flood outlines for surface water flooding it is difficult to provide a detailed assessment of this. Given that surface water systems are generally designed to a 30 year event standard it is likely that in Knowsley and Sefton, as elsewhere nationally, increased storminess and rainfall intensities will lead to increased flooding from surface water systems.

With regard to fluvial flood risk, recent guidance from DEFRA on assessing climate change sensitivity recommends assuming a 10% increase in fluvial flow up to 2025 and then an increase of 20% thereafter. In consultation with the Environment Agency and in line with their advice, it was agreed that in the absence of bespoke modelling data for a climate change event, the Environment Agency Flood Map 2 outline (where the annual probability of flooding is 0.1% Annual Exceedance Probability (AEP) or 1 in 1000 year event)) could be used in the SFRA to represent the fluvial and tidal climate change up to 2050 for Flood Zone 3a. This 0.1% AEP (1000 year event) outline is likely to be much larger than the 1% AEP (100 year event) with climate change outline and is, therefore, a conservative (worst case) estimate of the potential impacts of climate change. This Flood Map Outline is shown in Appendix G. Only Flood Zone 3a has an adjustment applied because there is a lack of data to estimate the effect of climate change on other zones. This approach has been accepted by the Environment Agency as the best solution to the current lack of data.

The possible effects of climate change on the fluvial flood regime through Knowsley and Sefton can be seen on the main watercourses of the River Alt, Fazakerley Brook, Knowsley Brook, Croxteth Brook, Boundary Brook, Netherley Brook and Logwood Mill Brook. As a result of increased fluvial flow rates, additional properties in the locations identified may fall within the 1% AEP outline (100 year event). Properties affected would include commercial, residential and industrial property and are shown in Appendix G.

For the tidal climate change scenario, this is represented by a staged increase, depending on how far into the future is being represented. Recommended contingency allowance for net sea level rise along the northwest of England coastline is: 2.5mm/yr until 2025, 7mm/yr between 2025 and 2055, 10mm/yr between 2055 and 2085, and 13mm/yr between 2085 and 2115 (Table B1, Annex B,

PPS25, Dec 2006). Climate change could affect the rate of erosion and deposition along the coastline, as well as increasing the current risks of overtopping.

The impacts of this broad scale representation of climate change upon the specific sites assessed within this SFRA are discussed later within this document. Appendix G shows the extents of these additional areas affected by the climate change scenario.

The sequential approach applied within the SFRA considers existing flood risk rather than the potential, future impacts to flood risk of climate change. The potential impacts of climate change should however be considered as part of the planning process with regards to sustainability.

4.1.2 Flood Sensitivity to Increased Urban Development.

It is clear from the Mersey Estuary and Alt Crossens CFMPs that opportunities exist to plan future urban development and regeneration whilst giving consideration to the management of flood risk within Knowsley and Sefton.

Appreciating the risk and reducing this risk by locating new developments appropriately or by making proposed developments resilient to flooding forms part of this strategic managed approach. This can be achieved through careful planning and development control.

Sensitive location, design and situation of development sites and buildings as well as mitigation measures can all contribute to reducing the risk of flooding, including:

- Steering developments outside of the floodplain, e.g. re-assessing potential site locations , land uses and designs;
- Applying property and location specific flood protection measures, e.g. use of removable flood gates, ground floor parking, water resistant construction etc.;
- Improving property resilience to flood damage, e.g. use of materials, raise level of electrical fittings;
- Identifying river corridors and the natural flood plain with the potential to provide riverside flood storage and urban river corridors in built up areas;
- Applying sustainable urban drainage techniques for new developments;
- Minimising surface water run-off.

Huyton and Prescot, both in the Borough of Knowsley, are identified within the RSS as areas for potential economic development. The port area of Sefton Borough is an area of significant economic importance and potential future development.

New developments tend to increase the impermeability of sites through the construction of buildings and paved surfaces. This can result in increases in surface water run-off from the site that, in turn, can cause flooding elsewhere. Surface water run-off from new developments will generally need to be controlled to prevent an increase in flood risk. To do this, developers will need to carry out a Drainage Impact Assessment on these sites to demonstrate that proposed drainage infrastructure designs will mitigate the potential increases of site run-off as a result of development. The need to control surface water runoff is as equally important for the development of ‘greenfield’ sites as it is for the redevelopment of ‘brownfield’ sites. In both cases, it may be possible to use new developments as an opportunity to reduce existing flood risk in an area.

In some areas it may be appropriate to implement some form of sustainable urban drainage system (SUDS). However, it is beyond the scope of this SFRA to determine which approach would be suitable for specific areas. However, a geology map has been provided in Appendix E and this can be used to guide which types of SUDS may be appropriate. Issues such as potential contamination of brownfield sites should be considered as part of a site specific flood risk assessment when identifying SUDS for sites. In high and moderate permeability areas, infiltration and combined

systems are likely to be suitable, whilst in low permeability areas attenuation systems are likely to be more suitable.

- Infiltration systems allow surface water to discharge directly into the ground. These systems are only appropriate where ground conditions permit;
  1) a suitable water acceptance potential and
  2) in locations where groundwater recharge will not adversely affect drinking water aquifers as identified by the Environment Agency's source protection zones. These are available on the Environment Agency website.
- Attenuation systems use measures to store surface water. If designed at ground level, these can take up large areas of development sites, and therefore early consideration of such constraints is essential. Combined system SUDS designs can include a combination of infiltration and attenuation systems.
- Where these systems are not appropriate, other measures may be applicable; such as green roofs and rainwater recycling.

The Regional Spatial Strategy for the North West indicates that between 2003 and 2021 and beyond there should be a total of 8,100 new homes provided in the Knowsley area (65% of which should be on brownfield sites), whilst Sefton is expected to produce 9,000 new homes, at least 60% of which (averaged across Sefton and West Lancashire) should be on brownfield sites.

In relation to employment land in Merseyside (which includes both Knowsley and Sefton), the same document (under Policy W3) highlights a need for 1440ha of land over the period to 2021, 1728ha (including a flexibility factor) and for an extra allocation over the 2005 supply levels of 494ha. The Regional Spatial Strategy does not highlight what portion of these figures should be provided by Knowsley and Sefton respectively, however it does highlight the need for such land allocations in the area in the future.

A significant proportion of these new housing and economic developments will be on 'brownfield' sites, due to the large amount of green belt land in the Boroughs. Section 2.47 of the PPS25 Practice Guide states that "both the rates and volumes of run-off from new developments should be no greater than the rates prior to the proposed development, unless specific off-site arrangements are made which result in the same net effect"'.

Section 6 below and Appendix I indicate that some development sites or parts of sites in the Knowsley and Sefton Unitary Development Plans are within Environment Agency Flood Maps 2 and 3. As described above, development should be sensitively located and designed to reduce and mitigate the risks of flooding. PPS25 forms the framework for this process.

4.1.3 Raised Defence Breach and Overtopping Analysis

Overview

Areas behind flood defences are at risk due to the potential overtopping or breach of flood defences resulting in the rapid onset of fast-flowing and deep water flooding with little or no warning. Local Planning Authorities and developers need to consider these residual risk issues relating to a development.

The level of residual risk behind flood defences is dependent on the distance from and the relative elevation of the land in relation to the water source. Figure 3 below illustrates the various risk zones behind a river flood defence.

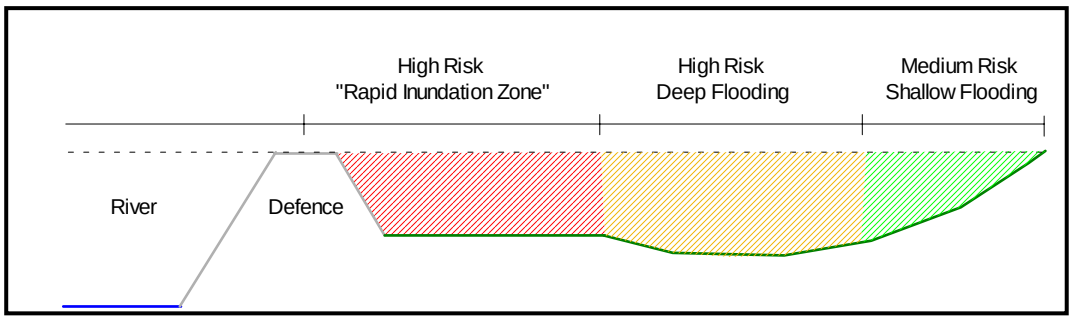


Figure 3: Risk Zone behind Flood Defences

A Rapid Inundation Zone is an area which is at risk of rapid flooding should a flood defence structure be breached or overtopped. The zone at highest risk from rapid inundation is the area located close behind a flood defence.

Breach of Defences

The breaching of a flood defence is a worst-case scenario for a flood event. During a breach event, a section of the flood defence fails, allowing large quantities of flood water to pass through the opening in the defence. The likelihood and scale of a breach is dependent on many factors, in particular, the material composition and condition of the defence.

DEFRA guidance FD2320[8] illustrates schematically, replicated below in Figure 4, how danger to people or flood hazard varies in relation to the distance from a defence (or breach location).

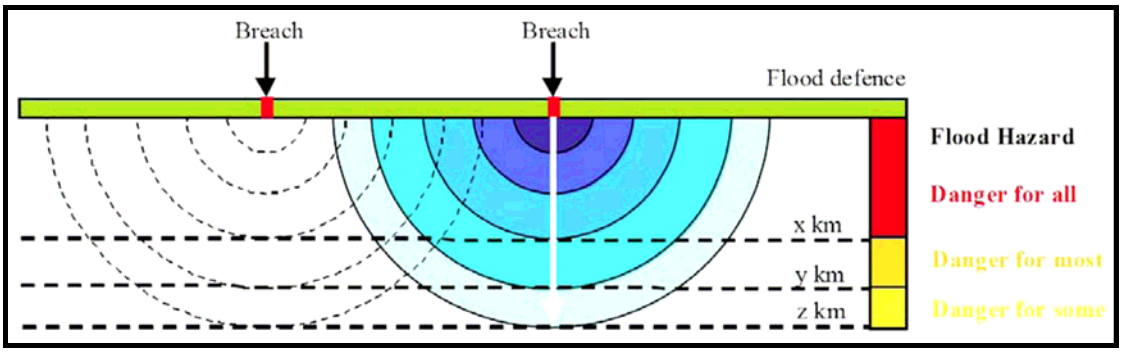


Figure 4: Flood Hazard from a Breach of Flood Defences

Overtopping of Defences

Where the existing defences have a standard of protection less than 1% Annual Exceedance Probability (AEP) (100 year event) they may be overtopped and even submerged during a 1% AEP (100 year event) flood event, refer to Figure 5. Out of bank flow will occur in a manner almost as if no defences existed. In these circumstances flood depths, velocities and extent can be expected to be similar to the undefended situation. Most of the defences do not offer a 1% AEP (100 year event) or greater standard of protection, and therefore do not influence the Flood Zones or development decision making, consequently, they have not been considered for site-specific breach and overtopping analysis.

[8] Flood Risk Assessment Guidance for New Development: Phase 2 R&D Technical Report FD2320/TR2; DEFRA, October 2005

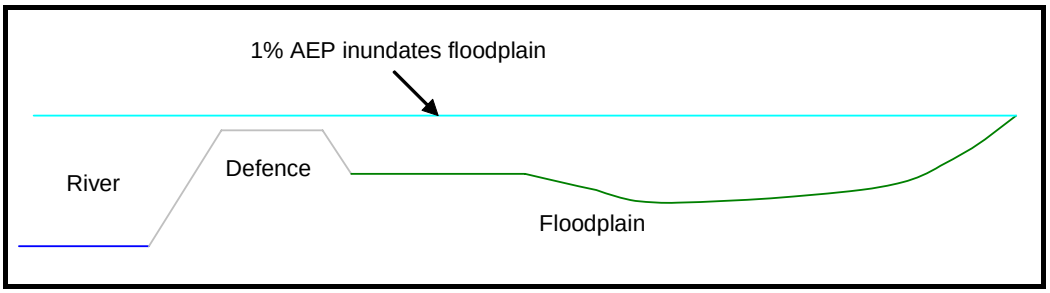


Figure 5: Overtopping of Defences with Standard of Protection less than 1% AEP

In the Sefton area, only the dunes at Altcar and Altmouth pumping station are stated in National Flood and Coastal Defence Database (NFCDD) as defending against 1% AEP (100 year) events. These two defences are therefore at lower risk of overtopping than all the other defences in the area, which have a standard of defence of less than 1% AEP (100 years). Areas benefiting from defences are shown to the north of Southport and the south of Formby and are shown in Appendix C.

There are no areas within Knowsley that benefit from formal EA flood defence assets, although there are formal flood defences along the River Alt in the form of raised linear embankments. NFCDD defence data obtained from the Environment Agency suggests these structures provide less than a 1% AEP (100 year event) flood defence provision. Therefore, a detailed breach or overtopping analysis has not been undertaken as these defences will be overtopped during a 1% AEP (100 year event) and, therefore, are not to be considered when making development decisions.

Undertaking site specific breach and overtopping analysis within Sefton is not considered appropriate because the Environment Agency Flood Maps have been created considering the undefended case. This means the area of flooding resulting from a breach of either of the pumping station assets at Altmouth and Crossens, is already contained by the Flood Map. All other defences in the area, which offer a standard of protection below the 1% AEP (100 year) event, have not been assessed for breach or overtopping analysis, as suggested in the PPS25 guidance. Defences with a standard of protection below the 1% AEP (100 year) event should not be considered when making development decisions.

A breach at the Altmouth and Crossens pumping stations would not increase the flood risk areas beyond those mapped by the Environment Agency Flood Map 2 and 3.

Within the Environment Agency NFCDD, a number of areas which benefit from tidal defences have been identified. These are primarily located to the south of Formby, directly upstream of the Altmouth pumping station, and to the north and east of Southport, upstream of the Crossens pumping station specifically in the areas surrounding Martin Mere. These areas are shown in Appendix C.

As explained within Section 3.5.4, upon completion of the SMP review process, the information and policy development of coastal flood risk management should be incorporated into future updates of the SFRA document.

5. Combined Risk Matrix Mapping

In an effort to assist the Councils in their understanding of flood risk in their areas, a Combined Risk Map has been produced (Appendix J). The map provides indicative zoning of combined flood risk to the Boroughs using fluvial and tidal flood zone maps, surface water flooding prevalence and ground water emergence mapping. For the purpose of this exercise, the combined risk mapping has utilised the Environment Agency Flood Maps to represent the PPS25 Flood Zones 1 and 2. The Flood Zones do not include areas at risk of breach or overtopping as the Environment Agency Flood Maps represent the undefended situation (the Flood Maps are shown in Appendix B).

The zoning categorisation of High, Medium and Low reflects the indicative level of importance flood risk will have on planning policy in both Knowsley and Sefton Council areas.

The High Risk Zone represents an area where a flood event could occur as a consequence of its location on Flood Maps 2 and 3 combined with surface water or ground water flooding. The combined flood risk issues in these areas are complex and potentially significant to future development policy in this zone. The high risk zone does not exclude development in these areas but it is likely that further, more detailed, investigations of flood risk in these areas will be required to satisfy planning procedure. Areas benefiting from defences have been included in this category, as the exact nature of the defence and the standard of protection offered cannot be guaranteed. The influence of any defences should be assessed by site specific flood risk assessments where appropriate.

The Medium Risk Zone represents an area which is outside of the Environment Agency fluvial and tidal Flood Maps 2 and 3, i.e. PPS25 Flood Zone 1, yet, information received from Knowsley Council, Sefton Council and the Environment Agency suggest the zone has a prevalence of surface water flooding and ground water emergence issues. This zone does not suggest the consequences of a flood event are less severe than in the High Risk Zone, more that flood risk is potentially less significant to future development policy.

The Low Risk Zone is an area where groundwater emergence poses the greatest risk. The severity and consequence of a flood event in this Low Risk Zone maybe similar in severity and consequence to an event in the Medium Risk Zone, yet flood risk is of low significance to future development policy within the Knowsley and Sefton Council areas.

The unshaded areas of the map indicate that the areas are outside of the Environment Agency Flood Map boundaries and have not been identified as an area of potential groundwater emergence or surface water flooding prevalence after review of available information. It does not suggest that these areas have no flood risk, it indicates that the best available information does not identify these areas to be at risk.

Appendix J shows the zoning of these areas for both Knowsley and Sefton Councils. The Combined Risk Map is not intended to be used in the Council's sequential testing of future developments, such as windfall sites. It is intended to provide an initial reference tool for determining the broad scale risks potentially affecting specific sites. The Risk Matrix does not replace or amend the requirements for site specific flood risk assessments which are described within PPS25.

6. PPS25 and the Sequential test for Knowsley and Sefton Unitary Development Plan and other allocations

6.1 Background

The Government expects Local Planning Authorities (LPAs) to apply a risk-based approach to the preparation of development plans and their decisions on development control. Planning Policy Statement 25: Development and Flood Risk (PPS25) requires LPAs, when allocating land in their DPDs for development, to apply the Sequential Test to demonstrate that there are no reasonably available sites in areas with a lower probability of flooding that would be appropriate for the proposed development.

To assist the LPAs to steer development away from areas affected by flood risk, the Environment Agency Flood Maps can be used to divide the local planning district into zones of high, medium or low flood risk. PPS25 is the key guidance for planners managing flood risk as it clearly defines the appropriateness of development type for each of the defined flood risk zones.

Guidance notes for developers and Local Planning Officers for appropriate use of this document, including when undertaking Sequential Testing, can be found in Appendix K.

6.2 Sequential Test

The Sequential Test should be applied throughout an entire planning authority district to ensure that all available sites are considered with reference to flood risk so that alternative sites are easily identifiable, should proposed land uses be deemed inappropriate.

A Sequential Test approach has been undertaken using the proposed land allocations as identified by both Knowsley and Sefton Councils within their adopted Unitary Development Plan(s) and existing Local Development Framework documents. Information available included proposed land uses and the boundary extents of these sites. Some details of intended uses have been provided but specific site plans for each site boundary have not. The analysis of the sequential testing on specific sites is provided in Appendix I. Furthermore, where required, sites which require Exception Testing have been identified.

The results of the Sequential Test detailed within this SFRA document provide the information required to ensure appropriate land uses are adopted for the level of flood risk across the Knowsley and Sefton Council areas.

6.3 Exception Test

If, after application of the Sequential Test, it is not possible to locate all proposed developments within areas of lower probability of flooding it may be appropriate to apply the Exceptions Test. PPS25 introduces the Exceptions Test.

If an authority can demonstrate, by way of the Sequential Test, that there are no reasonable available sites for development at a lower probability of flooding suitable for the intended use and type then the Exception Test can be applied. The Test provides a means by which an LPA can demonstrate that the proposed development is required for wider, sustainability reasons beyond the management of flood risk alone.

PPS25 paragraph D9 states that for the Exception Test to be passed;

1. *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage – see Figure 4 of PPS12: Local Development Frameworks – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;*
2. *the development should be on developable previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and*
3. *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

The Exceptions Test has not been undertaken for any sites as part of the SFRA, the Test should be applied by either Sefton or Knowsley Council where appropriate.

6.4 Flood Zone Definition

6.4.1 Introduction

This section describes the existing Environment Agency Flood Map, the process by which the existing Flood Zones were updated for the purpose of the SFRA utilising newly available information, and the application of the PPS25 Sequential Test.

6.4.2 Existing Flood Map

The Environment Agency Flood Map was described in detail within Section 3 of this SFRA. The Flood Map has informed the PPS25 Flood Zone definition as described by the table below.

Flood Probability	Environment Agency Flood Map	PPS25 Flood Zone
<0.1% AEP	Flood Map 1	Flood Zone 1
0.1% AEP	Flood Map 2	Flood Zone 2
1% AEP	Flood Map 3	Flood Zone 3a
4% or 5% AEP	Outline from Alt Crossens CFMP study showing a 4% AEP	Flood Zone 3b 'Functional Floodplain' (not applicable within Knowsley)

Table 6.1: Environment Agency data used in the definition of PPS25 Flood Zones

6.4.3 PPS25 Flood Zones and Flood Risk Vulnerability Classifications

PPS25 identifies 4 separate Flood Zones and 5 classes of development vulnerability. These are used to determine the suitability of proposed development uses when considering flood risk. These Flood Zones represent flooding without flood defences in place.

Flood Risk Vulnerability Classifications

Table D2 within Annex D of PPS25 classifies various types of development and land use in terms of its vulnerability to flood risk, as summarised below:

Vulnerability Class	Land Use
Essential Infrastructure	Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.

Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and Telecommunications installations required to be operational during flooding • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent
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	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place).
Water Compatible	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, **subject to a specific warning and evacuation plan**.

Flood Zones

Table D1 within Annex D of PPS25 defines and describes the Flood Zones, the appropriate uses and the policy aims within each zone, as summarised below:-

Flood Zone 1 is defined as 'Low Probability' of flooding and incorporates areas where the annual probability of flooding is lower than 0.1% AEP (1000 year event) in any year. PPS 25 imposes no constraints upon development here. It should be noted that flood risk should still be considered during development, despite the low probabilities and lack of prescribed methods of consideration.

Flood Zone 2 is defined as 'Medium Probability' with an annual probability of flooding between 0.1% AEP and 1.0% AEP (between 100 and 1000 year events) in any year for fluvial and 0.1% AEP and

0.5% AEP (between 1000 and 200 year event) in any year for tidal and coastal flooding. PPS25 recommends that Flood Zone 2 is suitable for most development with the exception of Highly Vulnerable uses, as defined within Table D.2 of PPS25.

Flood Zone 3 is defined as 'High Probability' with an annual probability of flooding of 1.0% AEP (100 year event) or greater in any year for fluvial and 0.5% AEP (200 year event) or greater in any year for tidal or coastal. PPS25 recommends that appropriate development is based upon a further classification of Flood Zone 3 into: 3a High Probability and 3b Functional Floodplain.

Functional Floodplain is defined as an area used for either flood storage or flood conveyance during periods of flood, and typically, represented by the 5% AEP (20 year) event or an area designed to flood in an extreme event such as a 0.1% AEP (1000 year) event. Greater constraints are placed upon development within Flood Zone 3b 'Functional Floodplain' compared to any other Flood Zone, refer to Table 6.2 for details.

As no data on fluvial climate change exists, it is considered that the most appropriate indication of the impacts of climate change is to use the existing Flood Zone 2 outline to represent Flood Zone 3a with climate change. This is a best practice approach and is fully endorsed by the Environment Agency as it overestimates (rather than underestimating) the risk posed by climate change. In accordance with PPS25, the climate change outline has not been used during the sequential approach adopted within this SFRA. With regards to the application of an Exception Test, the impacts of climate change to flood risk will be only one of many sustainability factors considered. Climate change impacts on flood risk are detailed in Section 4.1.1.

Flood Risk Vulnerability Classification (See Table D.2 of PPS25)		Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (See table D.1 of PPS25)	Zone 1 (Low Probability)	✓	✓	✓	✓	✓
	Zone 2 (Medium Probability)	✓	✓	Exception Test required	✓	✓
	Zone 3a (High Probability)	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b 'Functional Floodplain'	Exception Test required	✓	×	×	×
✓	Development is appropriate					
×	Development should not be permitted					

Table 6.2: Flood Risk Vulnerability and Flood Zone 'Compatibility'

6.5 Knowsley and Sefton PPS25 Flood Zones

For the purpose of this SFRA, Flood Map 2 will be used to represent the PPS25 Flood Zone 2 and Flood Map 3 will be used to represent the PPS25 Flood Zone 3a. The Flood Map data is being used because it is Environment Agency approved and the best data available for the SFRA Flood Zones. The Flood Zones are presented in Appendix F.

6.5.1 Flood Zone 3b, Functional Floodplain

For both the Knowsley and Sefton Council areas, definition of the PPS25 Flood Zone 3b, Functional Floodplain, is less straightforward. Functional Floodplain is defined as floodplain used for the purpose of storage or conveyance of water during high magnitude events. Where there is no specific information available, the 4 or 5% AEP (25 or 20 year event) outline is a reasonable representation of these areas and this method is approved by the Environment Agency. There was no information available for functional floodplains within the Boroughs, so other sources were investigated.

It was found that for areas within Sefton and the northern part of Knowsley, the Alt and Crossens CFMP base case output could be used to represent the functional floodplain. The return period chosen represents a probability of flooding of 4% AEP (25 year event) in any given year, compared to the 5% (20 year event) usually used to define the functional floodplain. Combined with other

anecdotal information and flood history along the river corridor, adoption of this methodology is deemed suitable by the Environment Agency.

The 4% AEP (25 year event) outline defined as part of the Alt Crossens CFMP does not identify flood risk within the southern half of the Knowsley area and in the absence of other information no functional floodplain within this area has been represented within the SFRA. It is recognised, however, that this is due to the absence of data and information rather than a demonstration that there is no flood risk, therefore, for the purpose of the Sequential Test a conservative approach has been adopted and the Flood Zone 3 outline has been used to identify sites potentially within the functional floodplain.

Flood Studies scheduled for delivery in April 2009 should provide a much clearer understanding of this flood zone definition which should be used to update the SFRA at a later date.

6.6 Assessing Flood Risk Using the Sequential Test

6.6.1 Overview

The Sequential analysis has been undertaken in two stages, the first stage is a preliminary analysis of flood risk across the Knowsley and Sefton areas to identify the different PPS25 Flood Zones and to identify the constraints that are imposed upon development within these zones. This initial assessment will provide council planners and developers the information that they will need to locate future development outside of flood risk areas or, at least, to low risk areas.

The second stage of the analysis includes a comparison of the potential housing and economic sites that have been identified by the Knowsley and Sefton Councils against these flood risk zones. Sites have been assessed to see what proposed uses would be appropriate given the levels of flood risk for each site. A summary is provided of these sites in Appendix I.

PPS25 states that when assessing flood risk to potential development sites, the worst case situation should be adopted, for example, a site with a small area within Flood Zone 3b and the majority within Flood Zone 1 would be classed as Flood Zone 3b. The sequential approach should be applied on a site specific basis, during separate site specific flood risk assessments, to inform the site planning process. An analysis was undertaken as part of this SFRA to identify the percentages of each site within each Flood Zone, Appendix I contains this information.

6.6.2 Methodology

Figure 6-1 below sets out the methodology adopted to undertake the Sequential Test in the form of a flow diagram. This diagram identifies the steps undertaken to identify the Flood Zones where each of the development allocation sites reside, these steps are outlined below;

1. Obtain the latest editions of the Environment Agency Flood Map and overlay within a Geographic Information System (GIS) for review (Appendix B).

2. Based upon catchment flood knowledge and other additional fluvial flood risk extents (as detailed in Section 3, define PPS25 Flood Zone 2 and 3. (Appendix F)

3. Identify Functional Floodplain (Flood Zone 3b), using existing 4% AEP (10 year event) flood outlines (Alt Crossens CFMP) and historic data if available. (Appendix F)

4. Consult with both Knowsley and Sefton Councils to identify all allocation sites within the Boroughs.

5. Overlay the GIS data for the allocation sites and the Flood Zone Map. (Appendix H)

6. Determine in which Flood Zone each of the allocation sites are located and tabulate the results.

7. Identify whether the intended use of each site is appropriate under PPS25 and make recommendations for additional assessment.

8. Highlight other flood risk sources which should be considered but do not affect the suitability of the site under the Sequential Test.

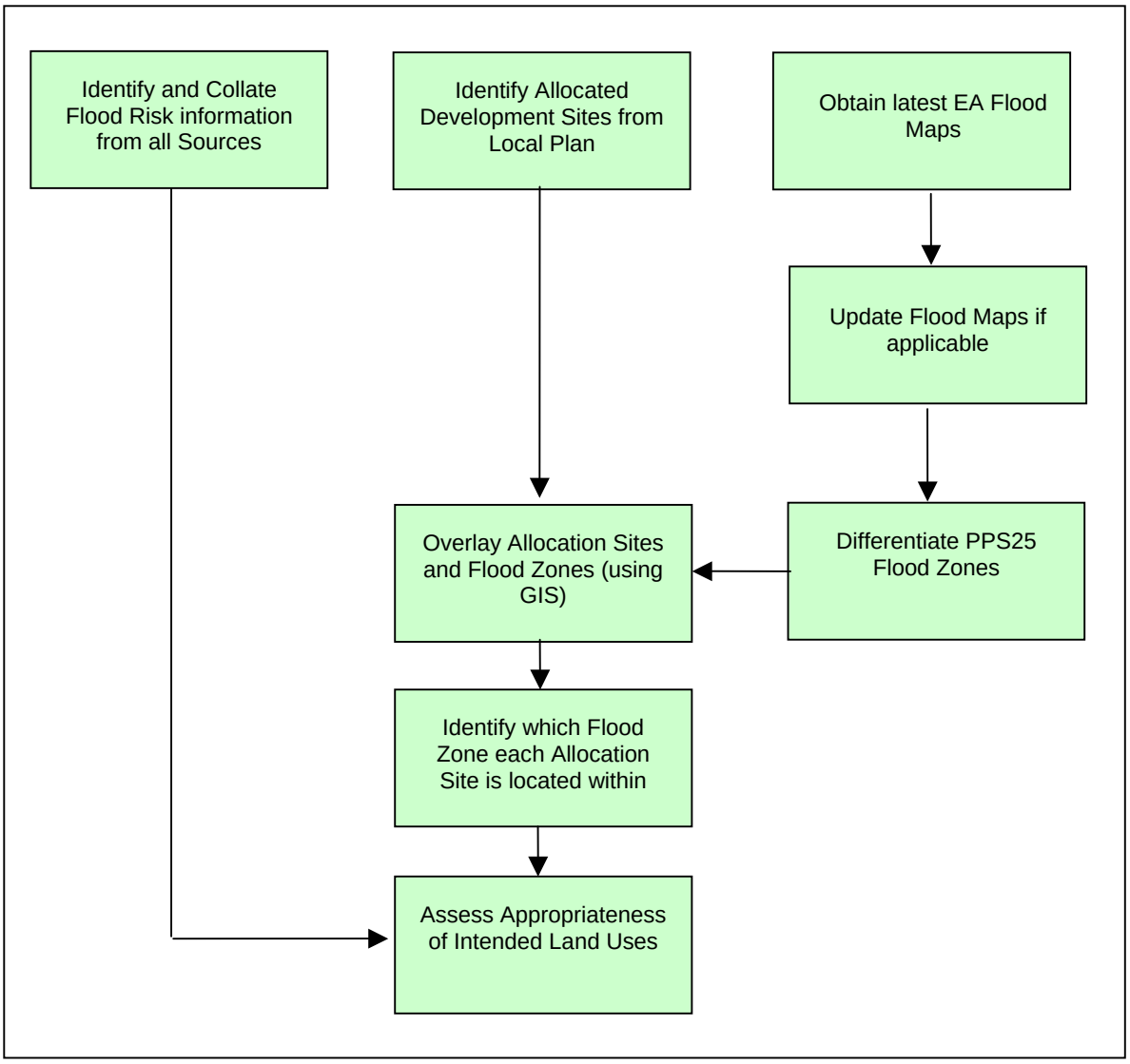


Figure 6-1: Flow diagram of Sequential Test Methodology

6.7 Knowsley Summary of Results

A summary of Knowsley Council Sequential Test results is provided in Table 6.3 below. The complete results of the analysis are contained within Appendix I and the plan showing the development sites and Flood Zones is in Appendix H.

It should be noted that the Flood Zone attributed to the allocation site represents the 'worst case' as prescribed by PPS25. No consideration is given to the proportions of the site within each floodplain which, at a site specific level of detail, may actually provide the required area for development outside of the 'worst case' Flood Zone. Appendix I provides a table of the proportions of each site that are within each Flood Zone classification, this information supports the following site specific comments.

Type of Allocation	Total Sites	Flood Zone 1 Low Probability	Flood Zone 2 Medium Probability	Flood Zone 3a High Probability	Potential Flood Zone 3b Functional Floodplain
Housing Development	8	7	-	1	1
Action Areas and Development Opportunity Sites	7	5	1	1	-
Employment Development	36	32	-	4	4
Transport	8	7	1		-

Table 6.3: Sequential Test Summary Results – Knowsley

6.7.1 Housing Development – Knowsley Council

Of the 8 housing development sites within the Borough, 7 sites fall within Flood Zone 1 'Low Probability' and 1 site falls within Flood Zone 3a 'High Probability'. Therefore, no constraint is imposed by PPS25 to restrict residential development on the 8 sites. The site which falls within Flood Zone 3a 'High Probability' will require an Exception Test.

The housing development site identified to be within Flood 3a 'High Probability' is located in an area where Functional Floodplain extents are not currently available. Therefore, the conservative approach has been taken and the site has been attributed to FZ3b for the purpose of this SFRA. It is recommended that this is reviewed once the Functional Floodplain outline is available.

6.7.2 Action Areas and Opportunity Sites- Knowsley Council

In total, there are 7 Action Areas and Opportunity Sites, 6 of these fall within Flood Zone 1 'Low Probability' and 1 partially falls within Flood Zone 3a 'High Probability', and therefore designated to be within Flood Zone 3a. The regeneration of these areas will provide new schools and new dwellings which better suit the areas and under PPS25, for the sites within Flood Zone 3a the intended uses are subject to passing the Exception Test. There are no constraints on the areas which fall within Flood Zone 1.

6.7.3 Employment Development - Knowsley Council

Of the 36 Employment Development Sites, 32 are located within Flood Zone 1 'Low Probability', and therefore have no restrictions under PPS25. The remaining 4 are located within Flood Zone 3a 'High Probability', all with the potential inclusion within the Functional Floodplain.

Location of the 'Less Vulnerable' type developments in Flood Zone 3a would be deemed appropriate and no Exception Test would be required.

For the 4 areas which have the potential to fall within Flood Zone 3b, PPS25 would classify the developments inappropriate for use. It is considered sensible to review the 4 identified sites once Functional Floodplain information becomes available.

6.7.4 Transport - Knowsley Council

There are 8 Transport development sites listed, 1 of these, the proposed Mersey Tram Route 2, falls within Flood Zone 2 'Medium Probability'. This type of proposed development is deemed compatible and appropriate for development under PPS25.

The 7 other Transport development sites are located within Flood Zone 1 'Low Probability' and, therefore, are not subject to constraints under PPS25.

6.8 Sefton Summary of Results

A summary of the Sefton Council Sequential Test results is provided in Table 6.4 below. The complete results of the analysis are contained within Appendix I and the plan showing the development sites and Flood Zones is in Appendix H.

It should be noted that the Flood Zone attributed to the allocation site represents the 'worst case' as prescribed by PPS25. No consideration is given to the proportions of the site within each floodplain which, at a site specific level of detail, may actually provide the required area for development outside of the 'worst case' Flood Zone. Appendix I provides a table of the proportions of each site that are within each Flood Zone classification, this information supports the following site specific comments.

Type of Allocation	Total Sites	Flood Zone 1 Low Probability	Flood Zone 2 Medium Probability	Flood Zone 3a High Probability	Flood Zone 3b Functional Floodplain
Transport Allocations	14	13	0	1	0
Industrial Sites	16	13	0	2	1
Housing Sites	10	9	0	1	0
Employment sites	5	5	0	0	0
Retail Sites	2	2	0	0	0
Development Brief	30	30	0	0	0
Other sites	7	4	1	1	1

Table 6.4: Sequential Test Summary Results – Sefton

6.8.1 Transport Allocations

Of the 14 transport development sites within the Borough, 13 sites fall within Flood Zone 1 'Low Probability' and, therefore, would not be constrained by PPS25. The remaining site (South Eastern Park and Ride) has been identified as lying within Flood Zone 3a 'High Probability'. However, this site has already been developed.

6.8.2 Industrial Sites

In total, there are 16 Industrial Sites, 13 of these fall within Flood Zone 1 'Low Probability'. As the intended uses of these sites is for industrial purposes no constraints are imposed on these developments under PPS25.

2 sites are located within Flood Zone 3a 'High Probability'. As industrial uses are 'Less Vulnerable', this is acceptable.

The Formby Business Park lies within Flood Zone 3b Functional Floodplain and its development should not proceed until other suitable sites of lower flood risk have been developed and the Exception Test is passed.

6.8.3 Housing Sites

There are 10 known proposed housing sites in the Borough of Sefton. 9 of these are located within Flood Zone 1 'Low Probability' and, therefore, deemed appropriate.

The remaining site is partially located within Flood Zone 3a 'High Probability'. This site is at Town Lane, Southport. This development will require an Exception Test.

6.8.4 Employment sites

All 5 employment sites within the Borough fall in Flood Zone 1, Low Probability and, therefore, are not subject to constraints under PPS25.

6.8.5 Retail sites

Both retail development sites within the Borough fall in Flood Zone 1, Low Probability and, therefore, are not subject to constraints under PPS25.

6.8.6 Development brief locations

All 30 development brief locations within the Borough fall in Flood Zone 1, Low Probability and, therefore, are not subject to constraints under PPS25. These individual sites contribute to wider SPG and SPD areas which have not been assessed independently within this SFRA.

6.8.7 Other sites

There are 7 other sites within the Borough. Four fall in Flood Zone 1, Low Probability and, therefore, are not subject to constraints under PPS25.

One site, Altcar Rifle Range falls into Flood Zone 2, Medium Probability, and where a highly vulnerable development will require an Exception Test. However other developments will be acceptable. Just over 20% of this site falls in Flood Zone 2, with the rest in Flood Zone 1.

Another further site, Ashworth Hospital, falls into Flood Zone 3a, High Probability, meaning that 'Essential Infrastructure' and 'More Vulnerable' developments will require an Exception Test, whilst a 'Highly Vulnerable' development would be unsuitable. Just under 3% of the site falls in Flood Zone 3a, with just over 1% of the site falling in Flood Zone 2 and the remainder of the site falling in Flood Zone 1.

One site, the Power House Site, falls within Flood Zone 3b, Functional Floodplain, where 'Highly', 'More' and 'Less Vulnerable' developments are considered inappropriate and Essential Infrastructure developments will require an Exception Test. 0.5% of the site falls in Flood Zone 3b, 81.4% in Flood Zone 3a, 10.5% of the site is in Flood Zone 2 and the remainder (7.6%) is in Flood Zone 1.

Appendix H contains a map showing the location of all 84 land allocations and the Flood Zones within which they are located.

6.9 Windfall Sites

Proposed development for "windfall sites" will by definition not derive from any potential development sites that have been assessed within this section. The Sequential Test will need to be carried out and, if necessary, the Exception Test at the planning application stage. Appendix K provides guidance notes to developers on how to use the Sequential Test for development sites including windfall sites. The combined risk matrix map contained in Appendix J gives indicative zoning of combined flood risk using fluvial and tidal flood zones, surface water flooding prevalence and ground water emergence mapping. The Combined Risk Map allows an initial visualisation of the relevance of flood risk to any development proposal and should be used only as a guide.

Application of the Sequential Test for windfall sites will require consideration of the PPS25 Flood Zones as shown in Appendix F as the primary source of information and will be supported by information in Appendices A, C, D, E and J.

7. Flood Management

7.1 Options for Knowsley and Sefton

7.1.1 Fluvial Flood Risk

As described within Sections 3.7.3 and 3.8.2, a number of studies are currently ongoing within the Knowsley and Sefton areas to assess the level of flood risk through the built environment. These include the Catchment Flood Management Plan (CFMP) studies which are broad scale strategic investigations that make flood risk management policy recommendations rather than site specific recommendations. The broad scale recommendations of the Alt Crossens and Mersey Estuary CFMPs for long term flood risk management within the areas of Sefton and Knowlsey are;

- to maintain the current standard of protection (accepting that flood risk will increase over time);
- to take further action to sustain the current level of flood risk;
- or in one area only, to increase the frequency of flooding to reduce flood risk elsewhere. v

The Environment Agency recommends this increased frequency of flooding policy in the rural and unpopulated area of Altcar and Ince for the benefit of inhabitants in Formby and Maghull.

At present there are a number of studies which are underway that may recommend flood management options as part of study outcomes. As these projects have not yet been finalised, it is not possible to include their recommendations in this document. However when available, the findings should be included in future updates of this SFRA.

7.1.2 Surface Water Flood Risk

The promotion of sustainable water management techniques for developers should contribute towards a reduction or at least a stabilisation of surface water flood risk. The geology maps contained within Appendix E can be used to identify areas where opportunities for SUDS may exist. For example, the use of soakaways on permeable bedrock goes some way to reducing future flood risk, where contamination of brownfield sites is not a consideration. Other techniques include increasing permeability of driveways and the use of green roofs. Further investigation of such schemes is recommended.

There is a risk of flooding from the Leeds Liverpool canal, but this is very difficult to predict and, therefore, manage.

7.1.3 Groundwater Flood Risk

There is little national guidance on reducing the risk of groundwater flooding. It is suggested that the Environment Agency be contacted to get the latest advice.

7.1.4 Tidal Flooding

When considering the risks from tidal flooding, it is important to refer to the Council SMP and any coastal defence work that has been carried out. In this case, this information can be obtained from Sefton Council.

7.2 River Corridor Maintenance

One of the main contributory factors to flood risk through urban environments is the constriction of watercourses. These constrictions may take the form of blockages by vegetation, in channel shoals and berms, bank collapse or failure in part of bankside walls, culverts or bridges.

7.2.1 Main Rivers

Sefton contains a large number of defence embankments which serve to protect communities from tidal and fluvial flood risk, albeit at higher frequency events. These defences should be maintained in order to provide the standard of service for which they were designed. This is the responsibility of the Environment Agency. Similarly, Altmouth and Crossens pumping stations should be serviced and maintained to ensure they are able to provide the expected standard of defence.

7.2.2 Ordinary and other Watercourses

Routine and regular maintenance of the watercourses through urban areas is undertaken in Knowsley and will contribute to controlling the overall level of flood risk in these areas. Despite these efforts, there still remain some areas where flood risk remains from undersized and blocked culverts.

Regular and routine maintenance is not carried out by Sefton to the majority of watercourses, unless by individual riparian owners. Dobbs Gutter in Formby is cleared on an annual cycle, whilst other watercourses are cleaned on a four yearly basis. Apart from the ditch cleaning and the regular clearing of debris screens in Formby no other routine maintenance of watercourses in the Sefton area is undertaken.

Within the Knowsley area, it is known that Stockbridge Village along the River Alt has suffered in the past due to culvert blockage. Also, areas of Southport and Maghull experience the risk of flooding from structure blockage. This is the responsibility of both Councils, as well as riparian owners of watercourse reaches. It is recommended that these maintenance works are undertaken to keep the channels clear of debris.

7.3 Emergency Evacuation Routes

For the purpose of emergency planning, consideration should be given to the likelihood of flood risk occurring, and hampering, the safe evacuation of people along main arterial transport routes during large scale emergencies, for example a terrorism event in Liverpool.

Evacuation of Knowsley would utilise the M62 and A58 to escape to either the east or west during such an emergency, and the A580 to escape to the east. These routes are not shown to be within Flood Zone 3. Although a small section of the Liverpool to St Helens train line is located within the extents of the Flood Zone, it is probable that the route could be used as a means of evacuation to the east and west.

The major evacuation routes from the south part of Sefton are the M57, M58 and A59. The north of the borough would likely evacuate along the A565 and A570. Southport and Liverpool/Maghull train lines could also be used. These transport links are identified to be partially located within the extents of the Environment Agency Flood Zone 3 and therefore it is considered that they may not be passable during a severe flood event.

8. Conclusions and Recommendations

8.1 Conclusions

8.1.1 Flood Risk to the Boroughs

It has been found that the main source of flood risk throughout the boroughs is associated with flooding within the Alt and Crossens catchments and their tributaries in both Knowsley and Sefton and the Mersey tributary of Ditton Brook in the southern areas of Knowsley. After consultation with key stakeholders it has been established that there are other sources of flood risk but none on a similar scale to the fluvial flood risk. This information is collated in Appendix J.

Flood risk from surface water flooding is the secondary source of flood risk. This is supported by information collected from Knowsley and Sefton Borough Councils and United Utilities. Both districts are potentially affected by surface water flood risk. The sewerage system throughout the two boroughs is largely Victorian and may be under capacity or susceptible to blockages which result in this risk. The nature of surface water flooding prevalence can be seen in Appendix D. Areas of surface water flooding occurrence have been identified in both Boroughs and, whilst the locations of these areas should be considered by the Councils when making decision on development, the presence of surface water flooding does not, on its own, direct the results of sequential testing. Little information is currently available on the levels of risk posed by surface water flooding, however, modelling would enable the level of risk posed to be better understood.

The possible effects of climate change to the fluvial flood regime through Knowsley and Sefton can be seen on the main watercourses of the River Alt, Fazakerley Brook, Knowsley Brook, Croxteth Brook, Boundary Brook, Netherley Brook and Logwood Mill Brook. Climate change will also have a potential impact on surface water flooding; research indicates that the frequency and intensity of storm events will increase as a result of climate change leading to increased flow into the surface water drainage networks.

Climate change could also affect the rate of erosion and deposition along the coastline of Sefton, as well as increasing the present risks of overtopping of the natural and artificial flood defences in both Knowsley and Sefton Council areas.

As a result of these increased levels of flood risk, additional properties in the locations identified above may fall within the 1% Annual Exceedance Probability (AEP) (100 year event) extent as a result of climate change compared to the present day 1% AEP (100 year event).

Areas behind flood defences are at risk due to the potential overtopping or breach of flood defences resulting in the rapid onset of fast-flowing and deep water flooding with little or no warning. Local Planning Authorities and developers need to consider these residual risk issues relating to a development.

There already exists some flood risk to the Borough of Sefton from tidal sources. The areas most at risk have been identified as being Southport and Crosby, with parts of Hightown village likely to be at risk in the future because of erosion in that area, unless some coastal protection works are undertaken within the next few years.

Groundwater emergence zones, where groundwater can reach the surface, do exist across the two Boroughs. Areas for which groundwater flood risk is identified include Maghull, Kirkby, Huyton and Lydiate. There is little national guidance on reducing the risk of groundwater flooding. It is suggested that the Environment Agency be contacted to get the latest advice.

Information on the implications of these risks, found through the Sequential Test and how they impact development plans, is set out for each Borough under separate headings below.

8.1.2 The Sequential Test for Knowsley and Sefton Unitary Development Plan and other Allocations

With regard to fluvial flood risk, for the purpose of this SFRA, the worst case has been used to assess the implications of flood risk upon proposed development sites and intended land uses. Flood Zones used within this study represent the undefended situation regardless of any protection provided by any formal, informal or other structures which afford some degree of flood protection. Secondly, in applying the Sequential test of PPS25, the proposed development sites have been assessed on the basis of the greatest flood risk that affects any part of the site regardless of the proportion of the site that is affected.

There are fluvial flood defence structures within Sefton and Knowlsey that do provide some form of protection. Only the dunes by the pumping station assets at Altmouth and Crossens have a standard of protection sufficient for a 1% AEP (100 year) event. Therefore only these assets should be considered during planning decision making.

As part of the Sequential Test, areas benefiting from defences are not included in the analysis as they are not considered as separate areas. However, areas benefiting from defences should be considered preferentially as part of exception testing which does not form part of this SFRA. There are no areas benefiting from defences in the Knowsley area, however there are some areas to the north of Southport and to the south of Formby that are shown (in Appendix C) to benefit from defences.

Using the available information the following conclusions have been drawn in relation to the potential development sites identified within the Boroughs of Knowsley and Sefton.

Knowsley

Of the 8 potential housing sites, 7 are located within Flood Zone 1 and are, therefore, suitable, under PPS25, for housing development. The remaining site has been identified within Flood Zone 3a, and potentially within Flood Zone 3b, and therefore requires an Exception Test at the stage of any future land allocations under the LDF to justify development in this high probability flood risk area. In the interim period, should any planning application come forward for housing development at the site there would be a requirement for a detailed site specific FRA to be submitted with the planning application. Through the FRA the implications of flood risk, and (if appropriate) mitigation measures, for the developability of the site would be fully assessed.

Of the 7 Action Areas and Opportunity Sites, 6 are located within either Flood Zone 1 or 2 and, therefore, are appropriate for the proposed developments. Flood Zone 3a intrudes into a small area of the remaining Action Area site, North Huyton, however this site has already been extensively developed.

32 of the 36 Economic development sites are located within Flood Zone 1 and are considered appropriate for the proposed development use. The 4 remaining sites are located partially within Flood Zone 3a and potentially within Zone 3b. Should these sites be found to be in Flood Zone 3b then they are considered inappropriate, whereas, Flood Zone 3a is considered appropriate for the intended usages.

7 of the 8 Transport Areas are located within Flood Zone 1 and the remaining site is located within Flood Zone 2, therefore, all sites are appropriate for the proposed developments.

Sefton

Flood risk to the Borough of Sefton occurs from a variety of sources. Fluvial and tidal risk is of concern in areas adjacent to some watercourses and along the coastline. This forms the main constraint on sites being suitable for development use. In addition, there are a number of urban areas where surface water flooding has been highlighted as an issue. Whilst the prevalence of surface water flooding itself does not result in a site being deemed unsuitable for development, its presence should be considered and accounted for where a site specific flood risk assessment is

undertaken. Groundwater flooding has also been highlighted as being of concern in some areas. Again, the presence of groundwater flooding issues would not in itself preclude a site from being deemed suitable for use, but its presence should be noted and included in any site specific flood risk assessment. Indications of the locations of these different risks are given in the risk matrix map in Appendix J and Section 3.

Of the 10 potential housing sites, 9 are located within Flood Zone 1 and are therefore suitable, under PPS25, for housing development. Part of 1 of these sites, Town Lane housing site, Kew, has been identified within Flood Zone 3a and, therefore, requires an Exception Test to justify development in this high probability flood risk area.

13 of the 14 Transport Sites are located within Flood Zone 1 and therefore are appropriate for the proposed developments. The remaining site, Southport Park and Ride site, is within Flood Zone 3a and, therefore, requires an Exception Test if it is to be pursued as a development site. This is no longer relevant because the site has already been developed. 2 of these sites, North Mersey Railway and Southeastern Park and Ride, require site specific FRAs due to their size. However proposed station sizes have not been provided, and any development sites with an area greater than 1 hectare will also require a site specific FRA.

15 of the 16 Industrial Areas are located within Flood Zone 1, 2 or 3a and therefore are appropriate for the proposed developments. The remaining site, at Stephenson Way, Formby, is within Flood Zone 3b and is, therefore, considered to be in a location unsuitable for development.

All 5 of the proposed employment sites fall in Flood Zone 1 and are, therefore, considered appropriate for the proposed developments.

Both of the proposed retail sites fall in Flood Zone 1 and are, therefore, considered appropriate for the proposed developments.

All 30 of the development brief sites are located within Flood Zone 1 and are therefore appropriate for the proposed development uses.

5 of the other development sites are located within Flood Zone 1 or 2 and therefore are appropriate for the proposed developments. One site, Ashworth Hospital, is contained in Flood Zone 3a and therefore considered appropriate while the remaining site, Power House Site, is located within Flood Zone 3b which is deemed inappropriate for the intended use.

The conclusions of this SFRA have been drawn together to support the Council's planning process and to inform planners of the potential flood risks across the Borough and the implications of those risks for development. This document and the supporting information should be used to help steer future developments to areas of least risk using a sequential approach to flood risk as detailed within the document.

8.2 Recommendations

8.2.1 Development of Core Strategy and Future Allocations Development Plan Documents

This SFRA document should be used to inform planning decision making and policy setting and therefore, future development of the Core Strategy and Allocations Development Plan Documents will need to consider the information set out here and in future revisions of this document.

Appendix F displays the PPS25 Flood Zones which inform the sequential approach. These figures are supported by the Risk Matrix Map in Appendix J and the flood risk information in Appendices A, C, D and E.

8.2.2 Site Specific Flood Risk Assessments

The site-based assessment has indicated that the majority of proposed UDP sites within Sefton require no further action, however a number of sites in Knowsley require site specific FRAs; in most cases because they are over 1 hectare in size. A greater level of detail should be provided by these

assessments with respect to flood risk and any protection afforded to the site, including from formal or informal flood defences.

Site specific FRAs may also be required for new sites such as windfall sites. All sites located within Flood Zones 2 or 3 or that are over 1Ha in size will require a FRA during the planning process. Refer to PPS25 for further details regarding requirement for site specific flood risk assessments.

Consideration should be given to the proportion of the site located within each of the PPS25 Flood Zones and the implications of this upon the planned layout of the site. This analysis will allow developments and land uses of greater vulnerabilities to flooding to be located on higher ground.

Where required, the Exception Test should be undertaken as part of the site specific FRAs. Refer to Appendix K for further guidance.

The Environment Agency would also point developers to the website www.pipernetworking.com/floodrisk for further and updated information concerning FRAs.

8.2.3 Channel Maintenance

The routine maintenance currently undertaken on the watercourses throughout the Boroughs of Knowsley and Sefton should be continued to ensure that the channels stay clear of debris and vegetation growth. This will reduce the risk of in-channel debris contributing to channel blockage, for example at upstream faces of culverts. Condition assessments of the bridges and engineered channel sections should continued on a regular basis.

Increasing the frequency of regular channel maintenance of watercourses, especially through urban areas and culverted watercourses, should be considered in areas of known flooding as this will help to reduce and manage flood risk.

8.2.4 Emergency Evacuation

The transport links used to evacuate Sefton Borough are identified to be partially located within the extents of the Environment Agency Flood Map 3. It is therefore considered that they may not be passable during a severe flood event. It is recommended that both Councils review and update, where necessary, their emergency flood risk response plans as a result of the findings and recommendations of the SFRA.

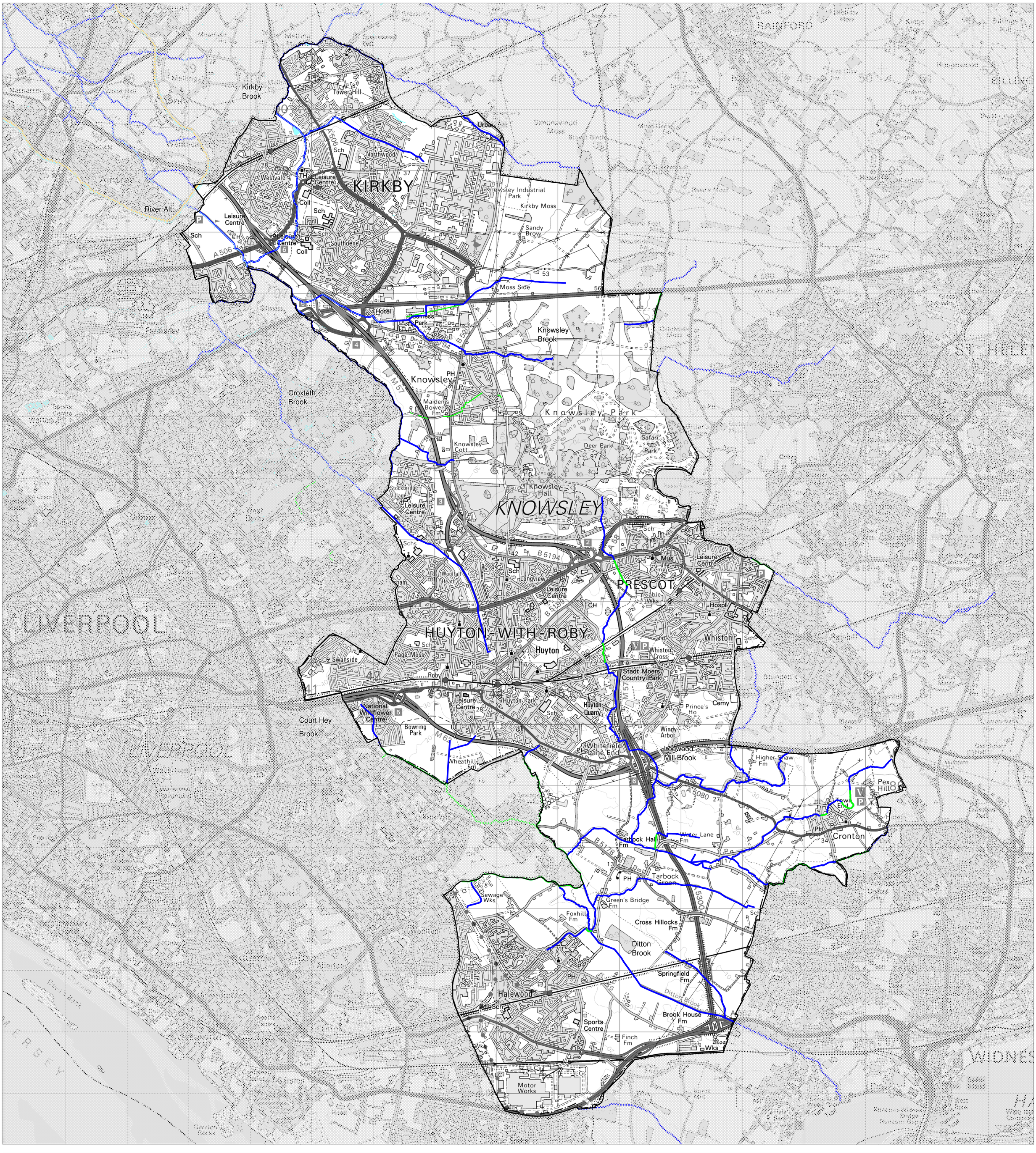
8.2.5 Review and update of the SFRA

It is recommended that this SFRA is revised regularly to incorporate new information and understanding of flood risk as and when it becomes available for the Knowsley and Sefton areas. This will provide planners and decision makers an evidence base which reflects current understanding of flood risk upon which informed decisions can be based. An example of this additional information would be the results and conclusions from the ongoing Formby Drainage study and other relevant studies.

This review should consider the following:

- Planning legislation
- National, regional and local planning policy
- Local planning aspirations
- Latest understanding of flood risk and flood management

info@atkinsglobal.com
www.atkinsglobal.com



Legend:

- Knowsley Boundary
- Water Bodies
- River Centrelines
- Canals
- Culverts

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

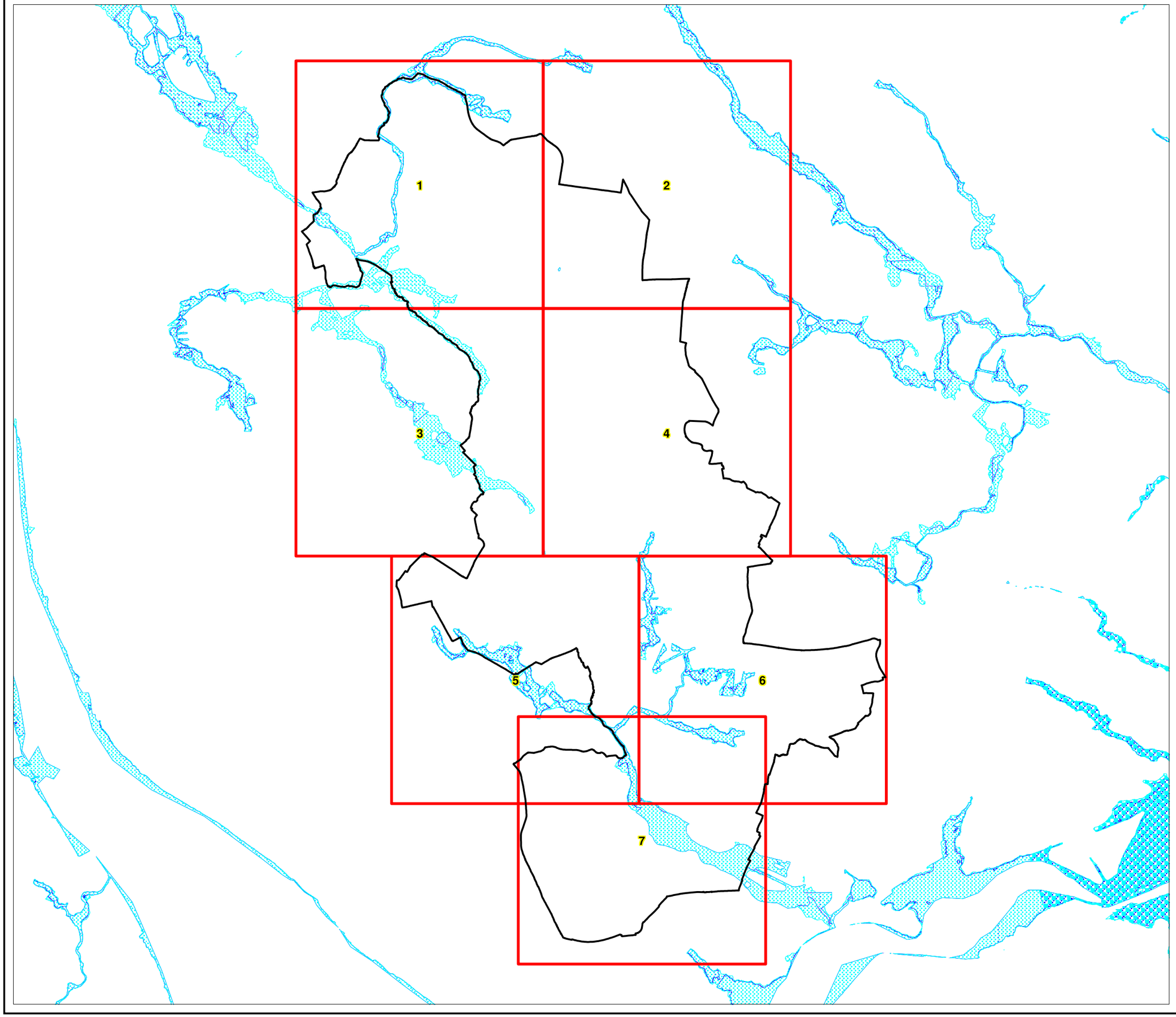
Watercourses in the Borough Areas Knowsley

Document Ref: **5074164/62/DG/002**

Figure Ref: **A1**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Fluvial Flood Map 3
- Fluvial Flood Map 2
- Flood Warning Areas (None Located in Knowsley)

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

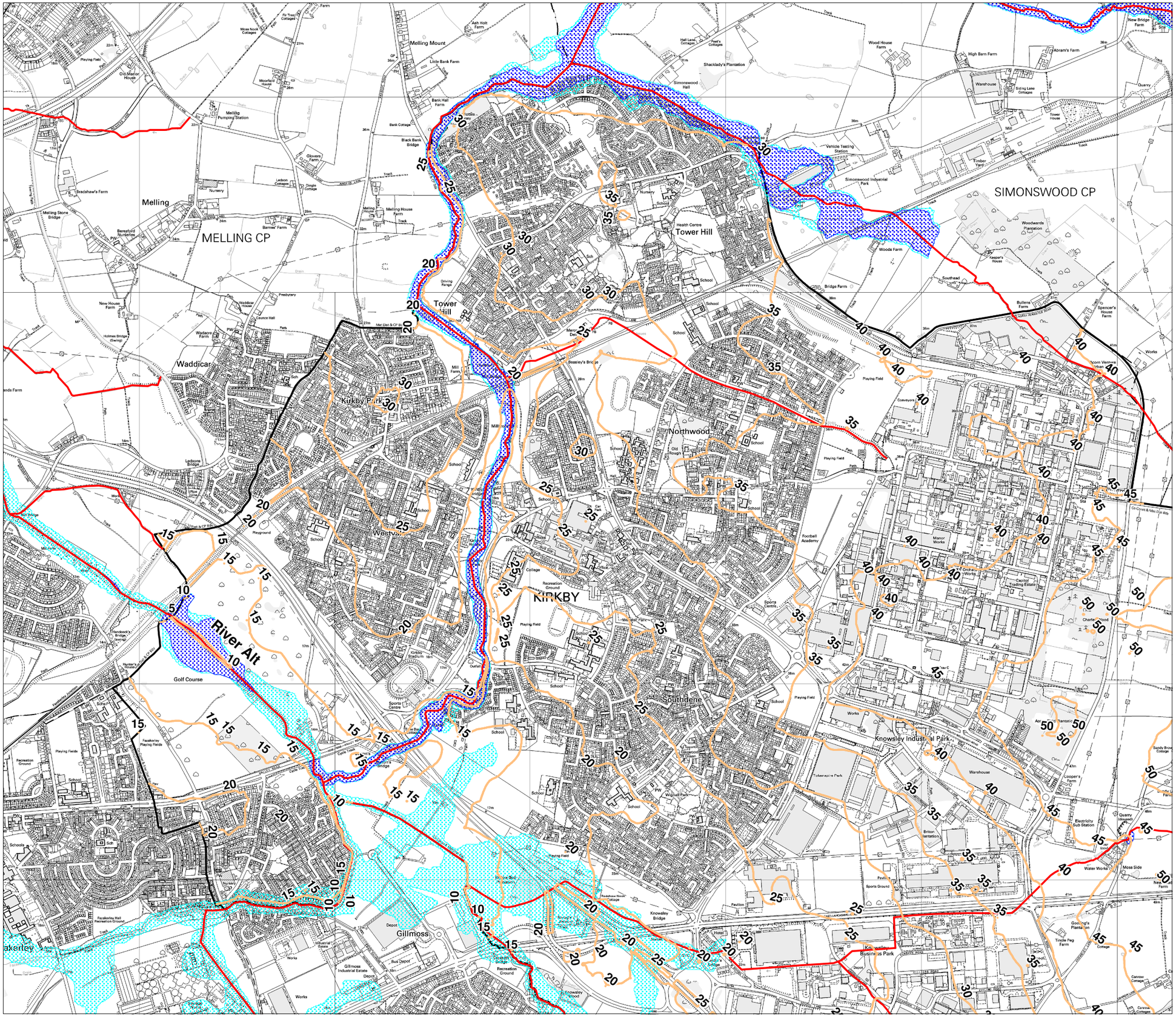
Environment Agency Published Flood Maps with contours and flood warning areas Knowsley Overview

Document Reference: **5074164/62/DG/002**

Figure Number: **B1-1**

Sefton Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Contour Lines
- Fluvial Flood Map 3
- Fluvial Flood Map 2
- Tidal Flood Map 3
- Tidal Flood Map 2
- Flood Warning Area (None located in Knowsley)

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

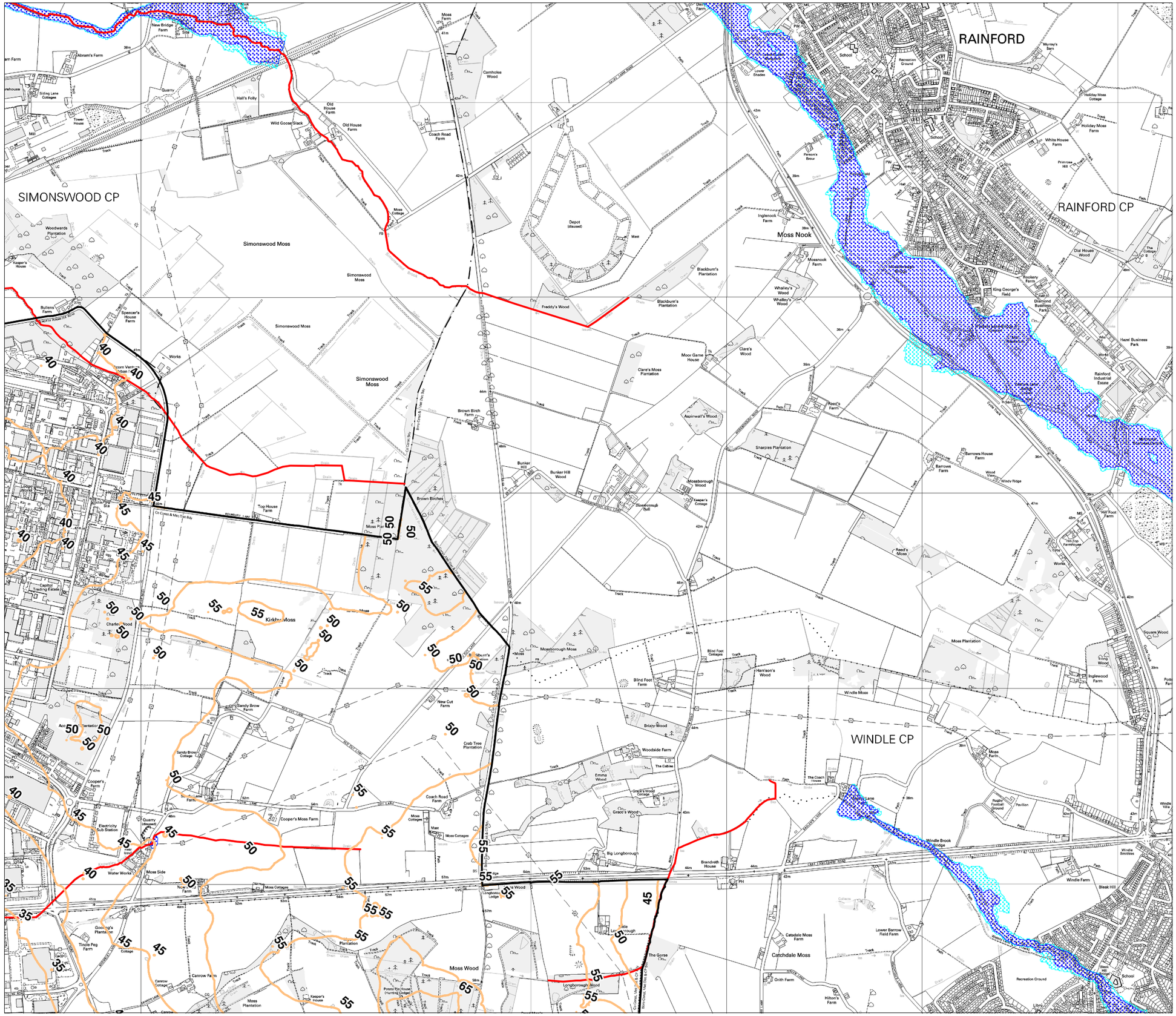
Figure Title:

Environment Agency Published Flood Maps with contours and flood warning areas Knowsley 1

Document Reference:	Figure Number:
5074164/62/DG/002	**B1-2**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Contour Lines
- Fluvial Flood Map 3
- Fluvial Flood Map 2
- Tidal Flood Map 3
- Tidal Flood Map 2
- Flood Warning Area (None located in Knowsley)

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

Environment Agency Published Flood Maps with contours and flood warning areas
Knowsley 2

Document Reference:	Figure Number:
5074164/62/DG/002	**B1-3**

Knowsley Council

ATKINS

Legend:

- Knowsley Boundary
- Watercourse
- Contour Lines
- Fluvial Flood Map 3
- Fluvial Flood Map 2
- Tidal Flood Map 3
- Tidal Flood Map 2
- Flood Warning Area (None located in Knowsley)

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

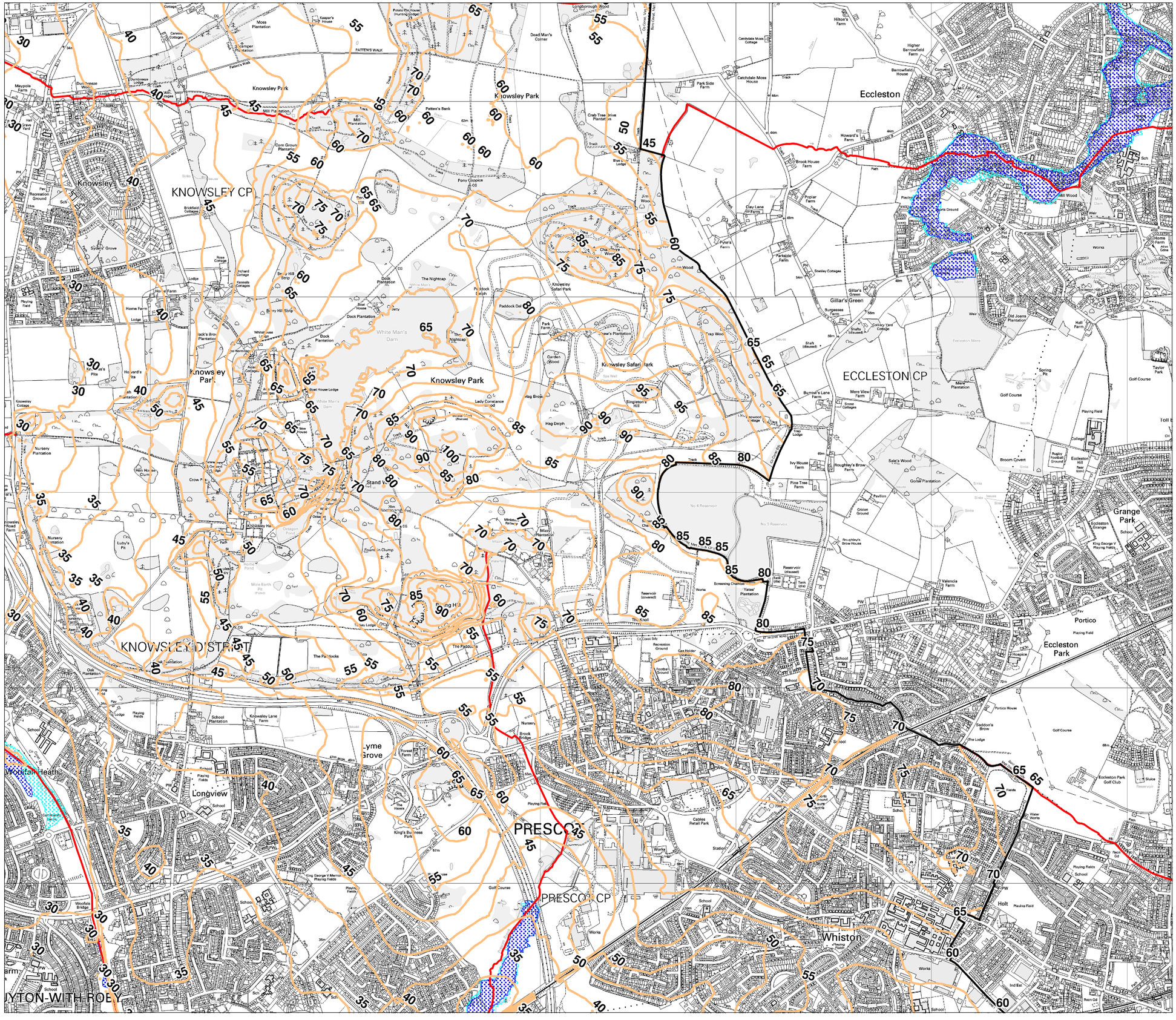
Figure Title:

Environment Agency Published Flood Maps with contours and flood warning areas
Knowsley 3

Document Reference:	Figure Number:
5074164/62/DG/002	**B1-4**

Knowsley Council

ATKINS



Legend:

Knowsley Boundary

Watercourse

Contour Lines

Fluvial Flood Map 3

Fluvial Flood Map 2

Tidal Flood Map 3

Tidal Flood Map 2

Flood Warning Area
(None located in Knowsley)

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

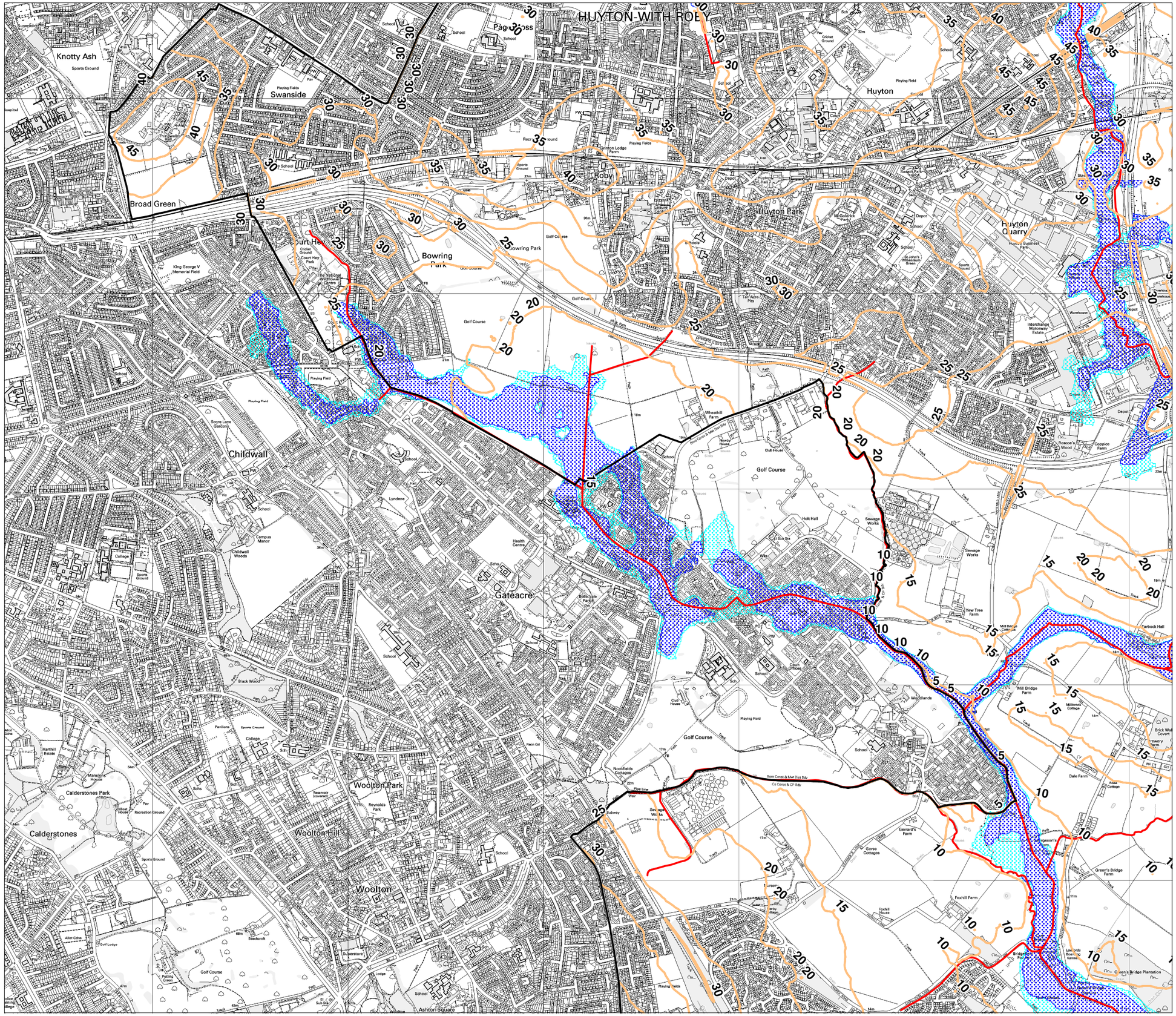
Figure Title:

Environment Agency Published Flood Maps with contours and flood warning areas
Knowsley 4

Document Reference:	Figure Number:
5074164/62/DG/002	**B1-5**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Contour Lines
- Fluvial Flood Map 3
- Fluvial Flood Map 2
- Tidal Flood Map 3
- Tidal Flood Map 2
- Flood Warning Area (None located in Knowsley)

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

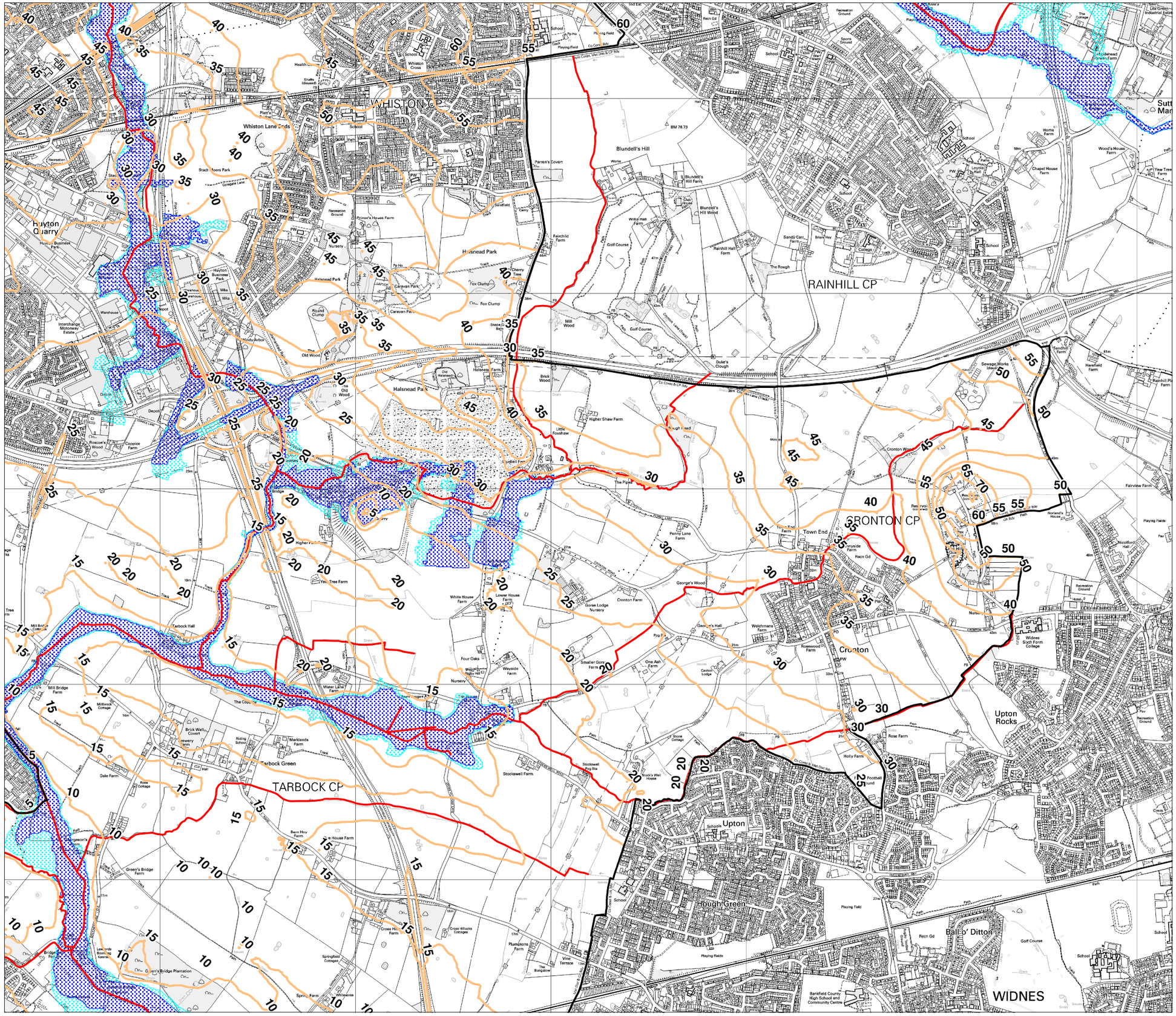
Figure Title:

Environment Agency Published Flood Maps with contours and flood warning areas
Knowsley 5

Document Reference:	Figure Number:
5074164/62/DG/002	**B1-6**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Contour Lines
- Fluvial Flood Map 3
- Fluvial Flood Map 2
- Tidal Flood Map 3
- Tidal Flood Map 2
- Flood Warning Area (None located in Knowsley)

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

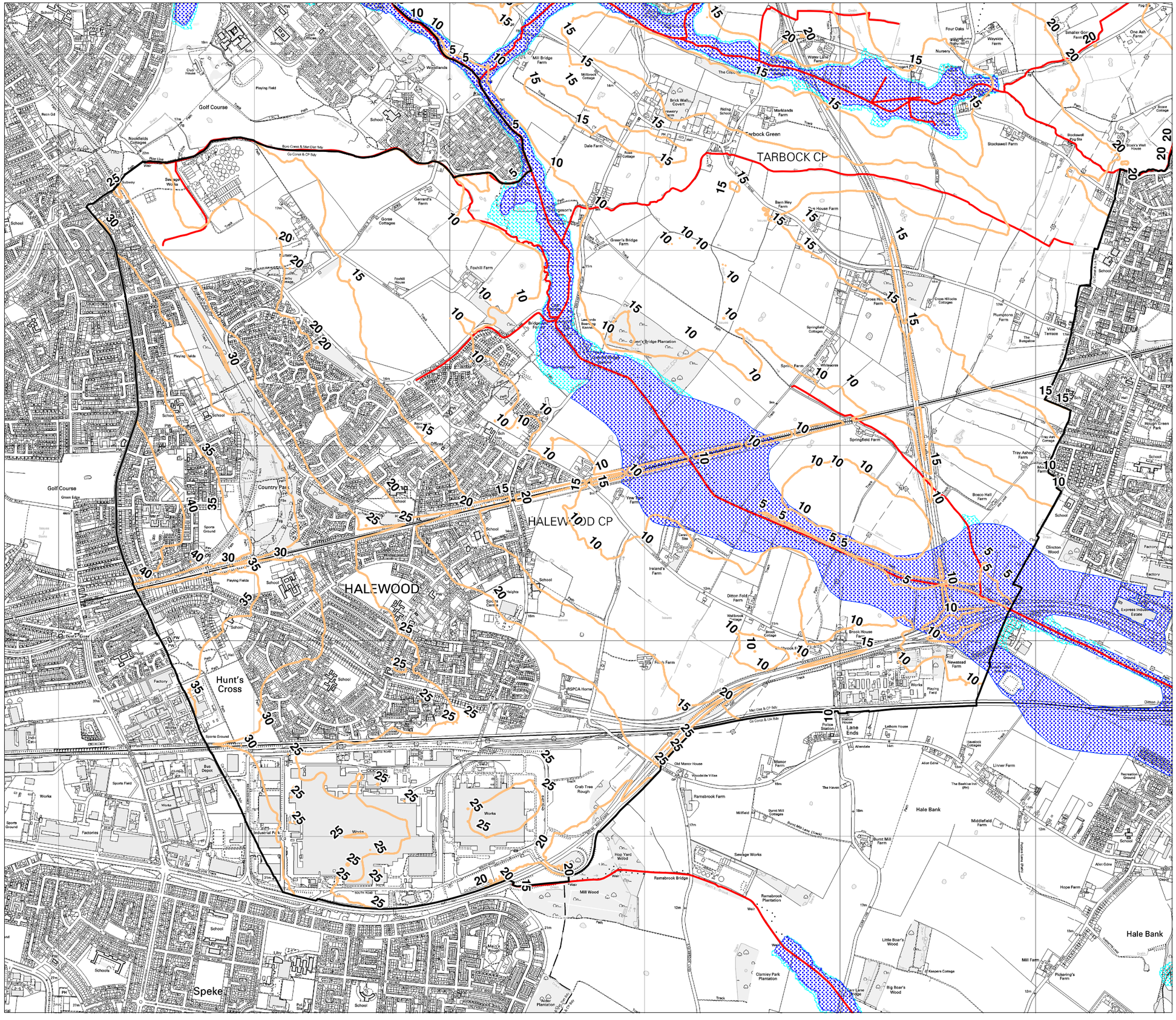
Figure Title:

Environment Agency Published Flood Maps with contours and flood warning areas Knowsley 6

Document Reference:	Figure Number:
5074164/62/DG/002	**B1-7**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Contour Lines
- Fluvial Flood Map 3
- Fluvial Flood Map 2
- Tidal Flood Map 3
- Tidal Flood Map 2
- Flood Warning Area (None located in Knowsley)

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

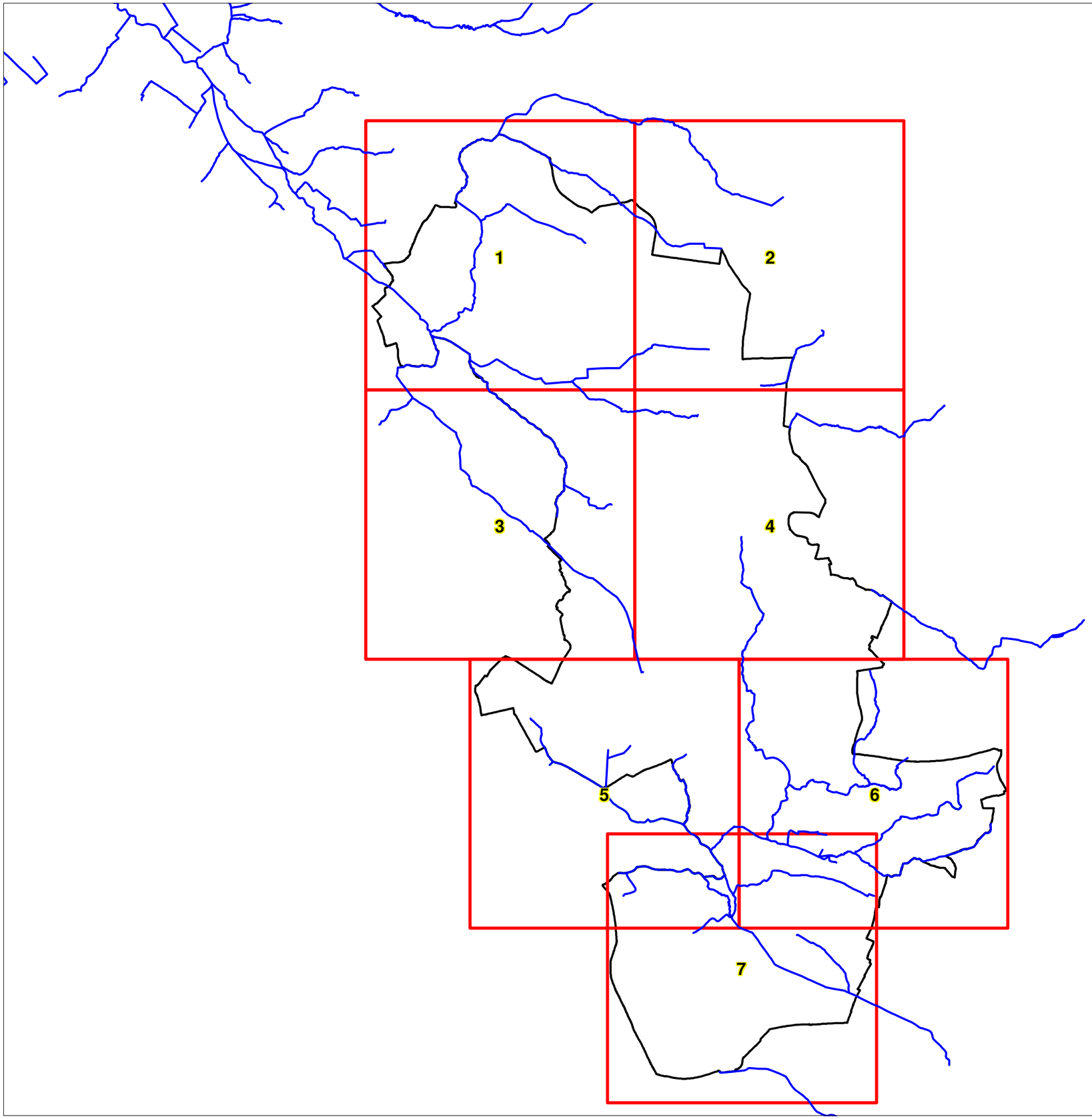
Environment Agency Published Flood Maps with contours and flood warning areas Knowsley 7

Document Reference: **5074164/62/DG/002**

Figure Number: **B1-8**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Areas Benefitting from Defences
- River Centrelines
- Coastal Protection
- Culverted Channel
- Flood Defence Structure
- Raised Coastal Defences
- Raised Defence Man Made
- Sea Defence Man Made
- Sea Defence Natural

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

Flood Defence Assets and Areas Benefitting from Defences
Knowsley Overview

Document Reference:	Figure Number:
5074164/62/DG/002	**C1-1**

Knowsley Council

ATKINS

Legend:

- Knowsley Boundary
- Areas Benefitting from Defences
- River Centrelines
- Coastal Protection
- Culverted Channel
- Flood Defence Structure
- Raised Coastal Defences
- Raised Defence Man Made
- Sea Defence Man Made
- Sea Defence Natural

Note: Knowsley Borough Council contains no areas benefitting from defences (ABD) due to a lack of defences that provide a 1% AEP event standard of protection. Further detail is given in Section 3.9.1 of the report.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

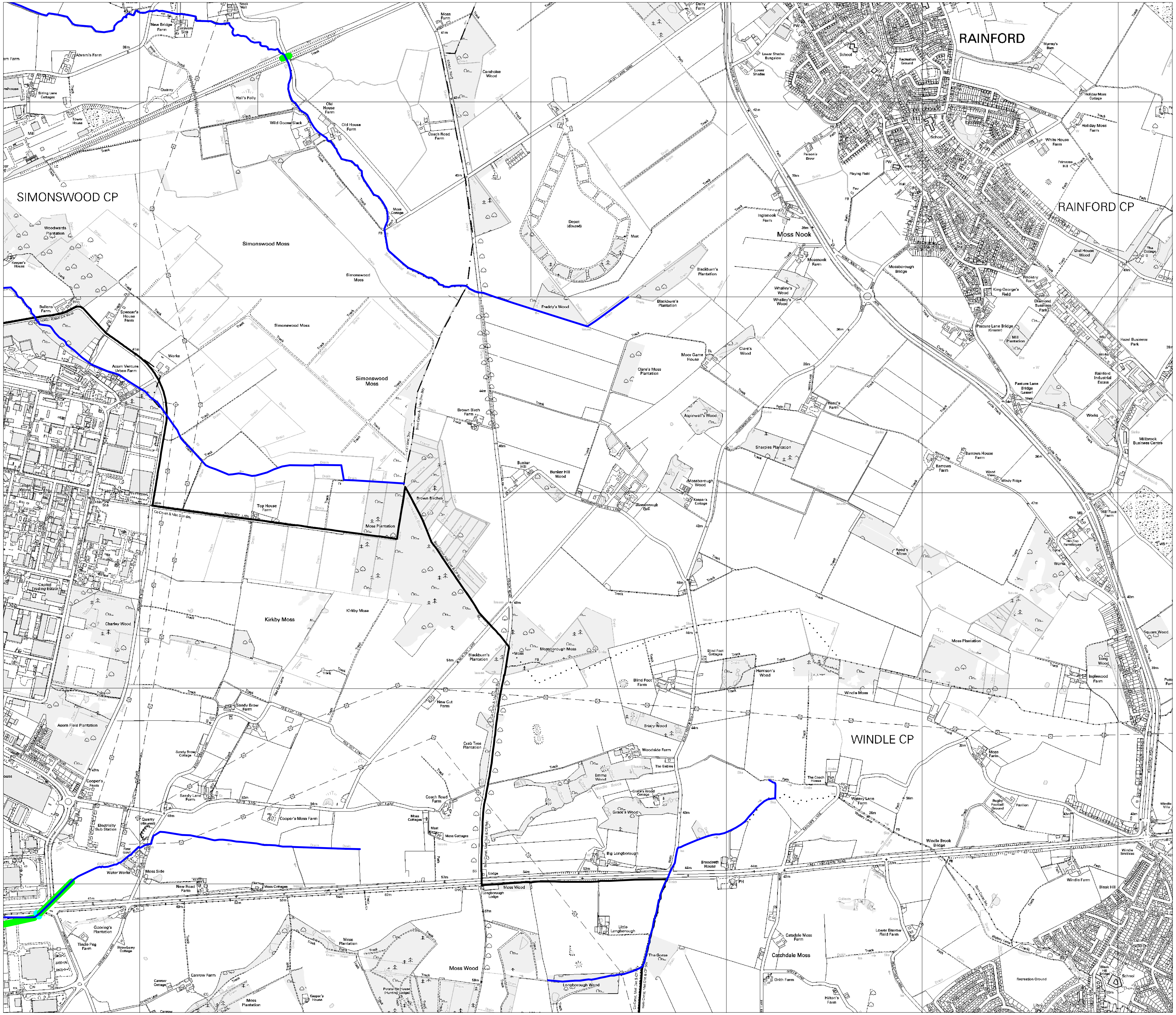
Flood Defence Assets and Areas Benefitting from Defences
Knowsley 1

Document Reference: **5074164/62/DG/002**

Figure Number: **C1-2**

Knowsley Council

ATKINS



Legend:

Knowsley Boundary

Areas Benefitting from Defences

River Centrelines

Coastal Protection

Culverted Channel

Flood Defence Structure

Raised Coastal Defences

Raised Defence Man Made

Sea Defence Man Made

Sea Defence Natural

Note: Knowsley Borough Council contains no areas benefitting from defences (ABD) due to a lack of defences that provide a 1% AEP event standard of protection. Further detail is given in Section 3.9.1 of the report.

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

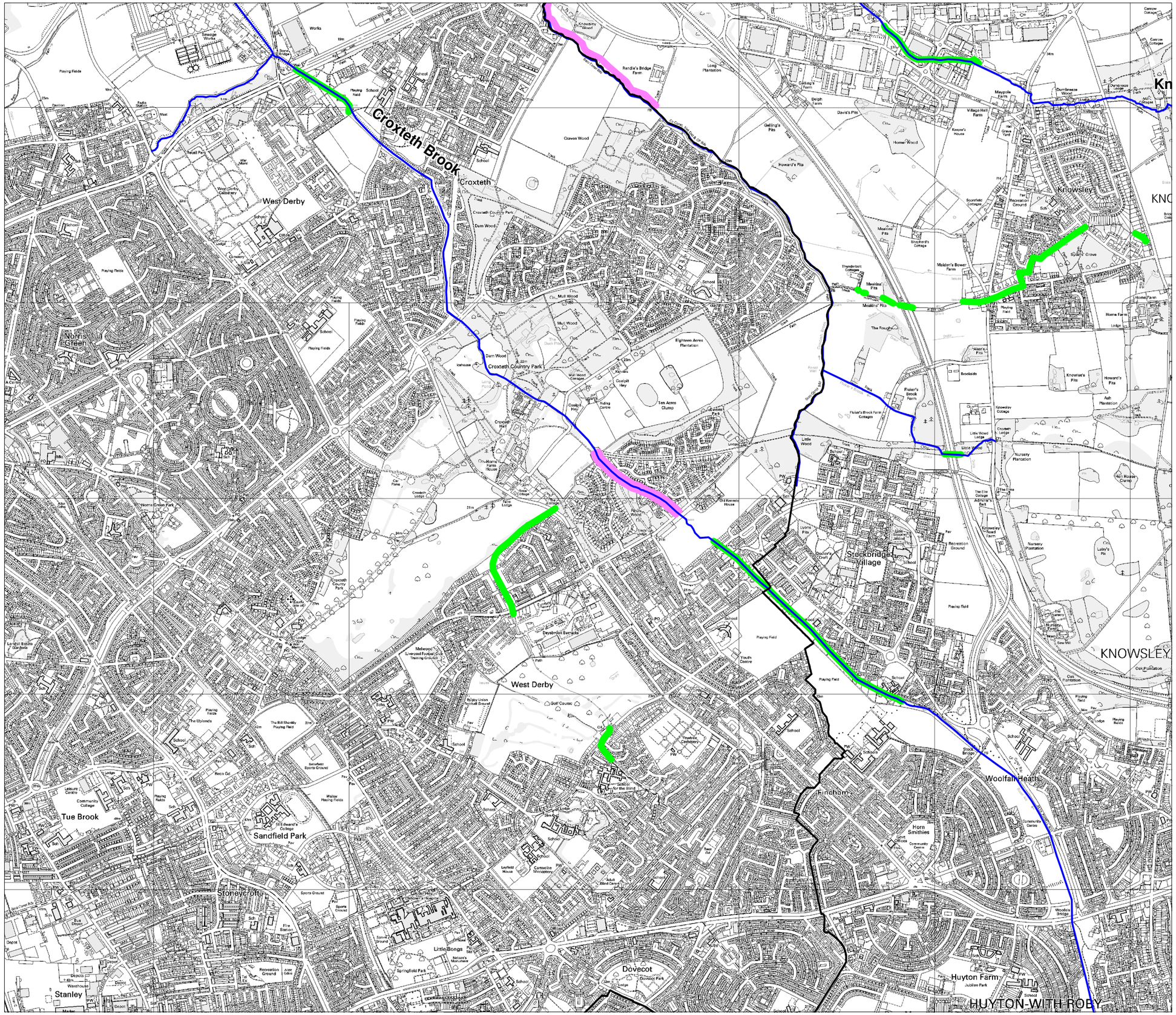
Flood Defence Assets and Areas Benefitting from Defences Knowsley 2

Document Reference: **5074164/62/DG/002**

Figure Number: **C1-3**

Knowsl@y Council

ATKINS



Legend:

- Knowsley Boundary
- Areas Benefitting from Defences
- River Centrelines
- Coastal Protection
- Culverted Channel
- Flood Defence Structure
- Raised Coastal Defences
- Raised Defence Man Made
- Sea Defence Man Made
- Sea Defence Natural

Note: Knowsley Borough Council contains no areas benefitting from defences (ABD) due to a lack of defences that provide a 1% AEP event standard of protection. Further detail is given in Section 3.9.1 of the report.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

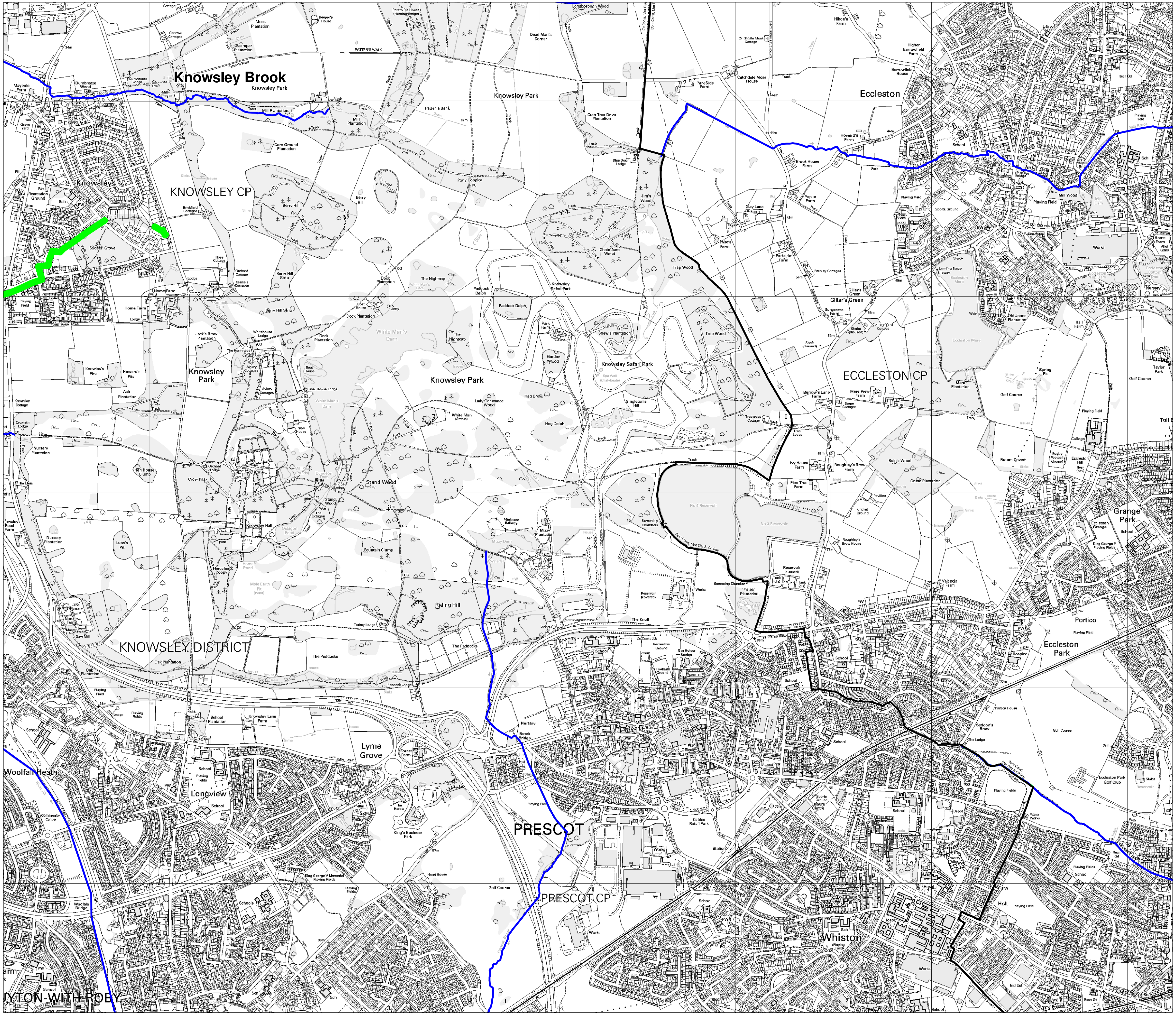
Flood Defence Assets and Areas Benefitting from Defences
Knowsley 3

Document Reference: **5074164/62/DG/002**

Figure Number: **C1-4**

Knowsley Council

ATKINS



Legend:

Knowsley Boundary

Areas Benefitting from Defences

River Centrelines

Coastal Protection

Culverted Channel

Flood Defence Structure

Raised Coastal Defences

Raised Defence Man Made

Sea Defence Man Made

Sea Defence Natural

Note: Knowsley Borough Council contains no areas benefitting from defences (ABD) due to a lack of defences that provide a 1% AEP event standard of protection. Further detail is given in Section 3.9.1 of the report.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

Flood Defence Assets and Areas Benefitting from Defences
Knowsley 4

Document Reference:	Figure Number:
5074164/62/DG/002	**C1-5**

Knowsl@y Council

ATKINS

Legend:

- Knowsley Boundary
- Areas Benefitting from Defences
- River Centrelines
- Coastal Protection
- Culverted Channel
- Flood Defence Structure
- Raised Coastal Defences
- Raised Defence Man Made
- Sea Defence Man Made
- Sea Defence Natural

Note: Knowsley Borough Council contains no areas benefitting from defences (ABD) due to a lack of defences that provide a 1% AEP event standard of protection. Further detail is given in Section 3.9.1 of the report.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

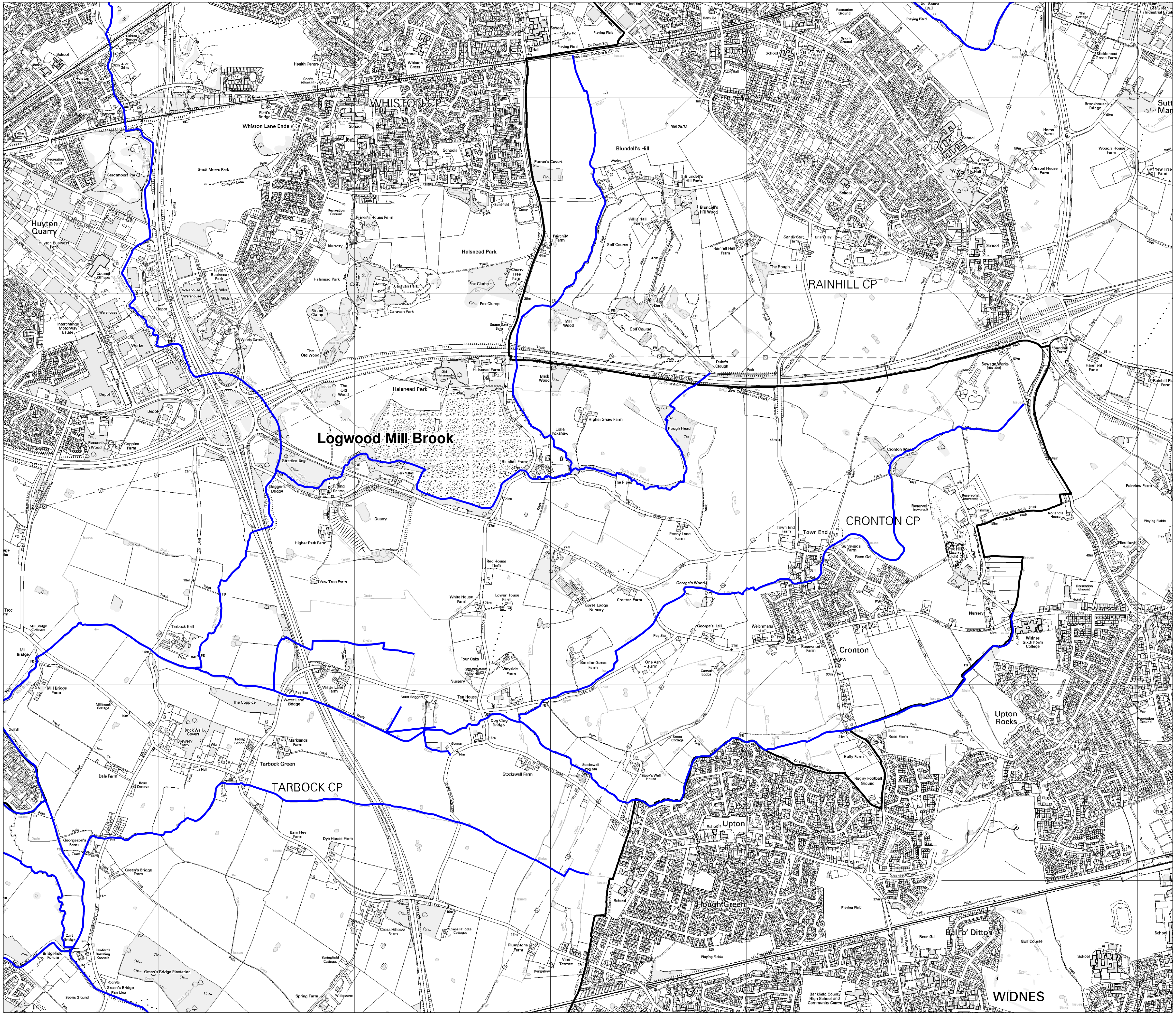
Flood Defence Assets and Areas Benefitting from Defences
Knowsley 5

Document Reference: **5074164/62/DG/002**

Figure Number: **C1-6**

Knowsley Council

ATKINS



Legend:

Knowsley Boundary

Areas Benefitting from Defences

River Centrelines

Coastal Protection

Culverted Channel

Flood Defence Structure

Raised Coastal Defences

Raised Defence Man Made

Sea Defence Man Made

Sea Defence Natural

Note: Knowsley Borough Council contains no areas benefitting from defences (ABD) due to a lack of defences that provide a 1% AEP event standard of protection. Further detail is given in Section 3.9.1 of the report.

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

Flood Defence Assets and Areas Benefitting from Defences Knowsley 6

Document Reference: **5074164/62/DG/002**

Figure Number: **C1-7**

Legend:

- Knowsley Boundary
- Areas Benefitting from Defences
- River Centrelines
- Coastal Protection
- Culverted Channel
- Flood Defence Structure
- Raised Coastal Defences
- Raised Defence Man Made
- Sea Defence Man Made
- Sea Defence Natural

Note: Knowsley Borough Council contains no areas benefitting from defences (ABD) due to a lack of defences that provide a 1% AEP event standard of protection. Further detail is given in Section 3.9.1 of the report.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

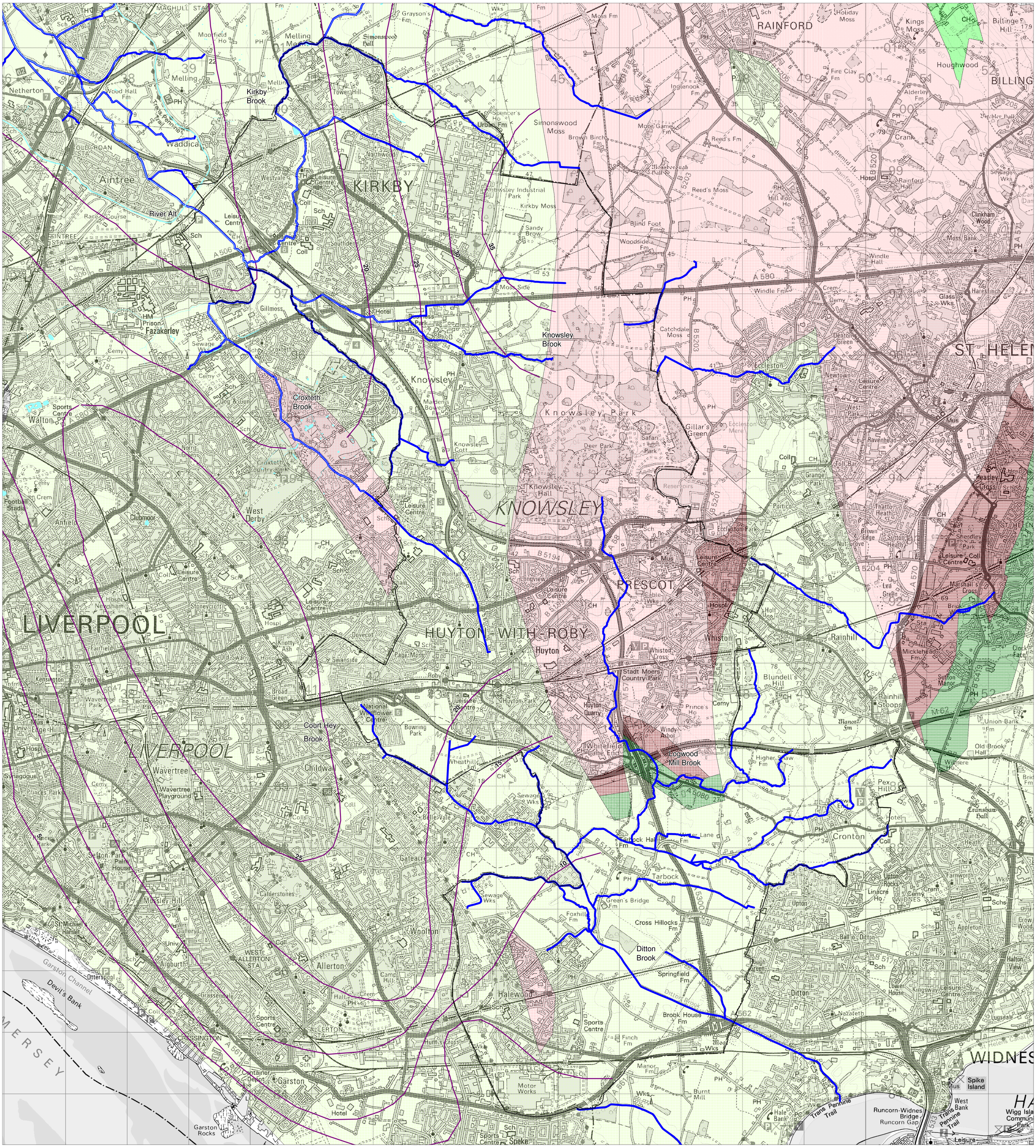
Flood Defence Assets and Areas Benefitting from Defences
Knowsley 7

Document Reference: **5074164/62/DG/002**

Figure Number: **C1-8**

Knowsley Council

ATKINS



Legend:

Solid Geology

- Knowsley Boundary
- Water Bodies
- River Centrelines
- Ground Water Level (mAOD)
- Lower Westphalian
- Triassic Sandstone
- Triassic Mudstone
- Upper Westphalian
- Westphalian
- Permian Sandstone and Mudstone

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

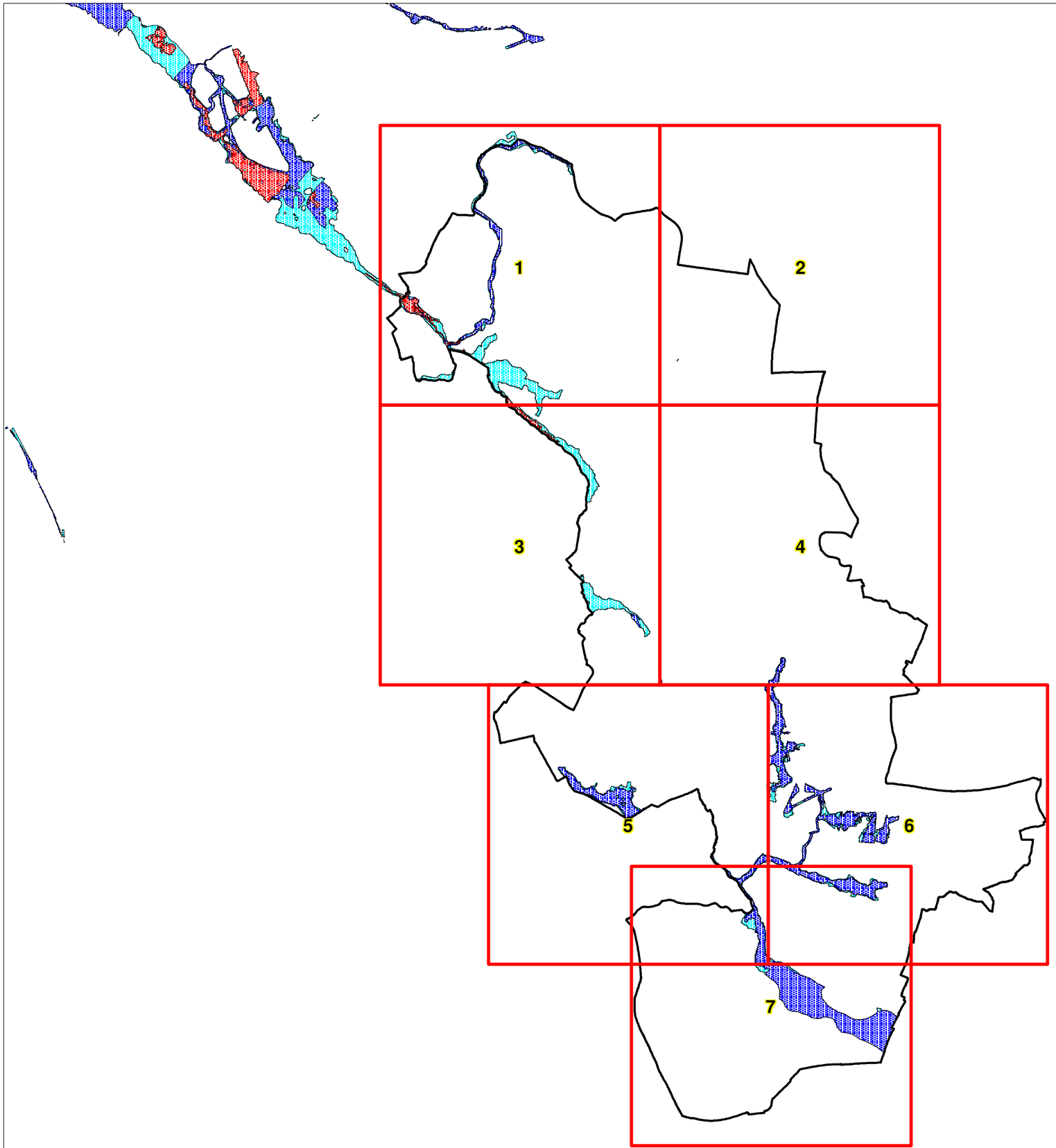
Ground Water and Geology Knowsley

Document Ref: **5074164/62/DG/002**

Figure Ref: **E1**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

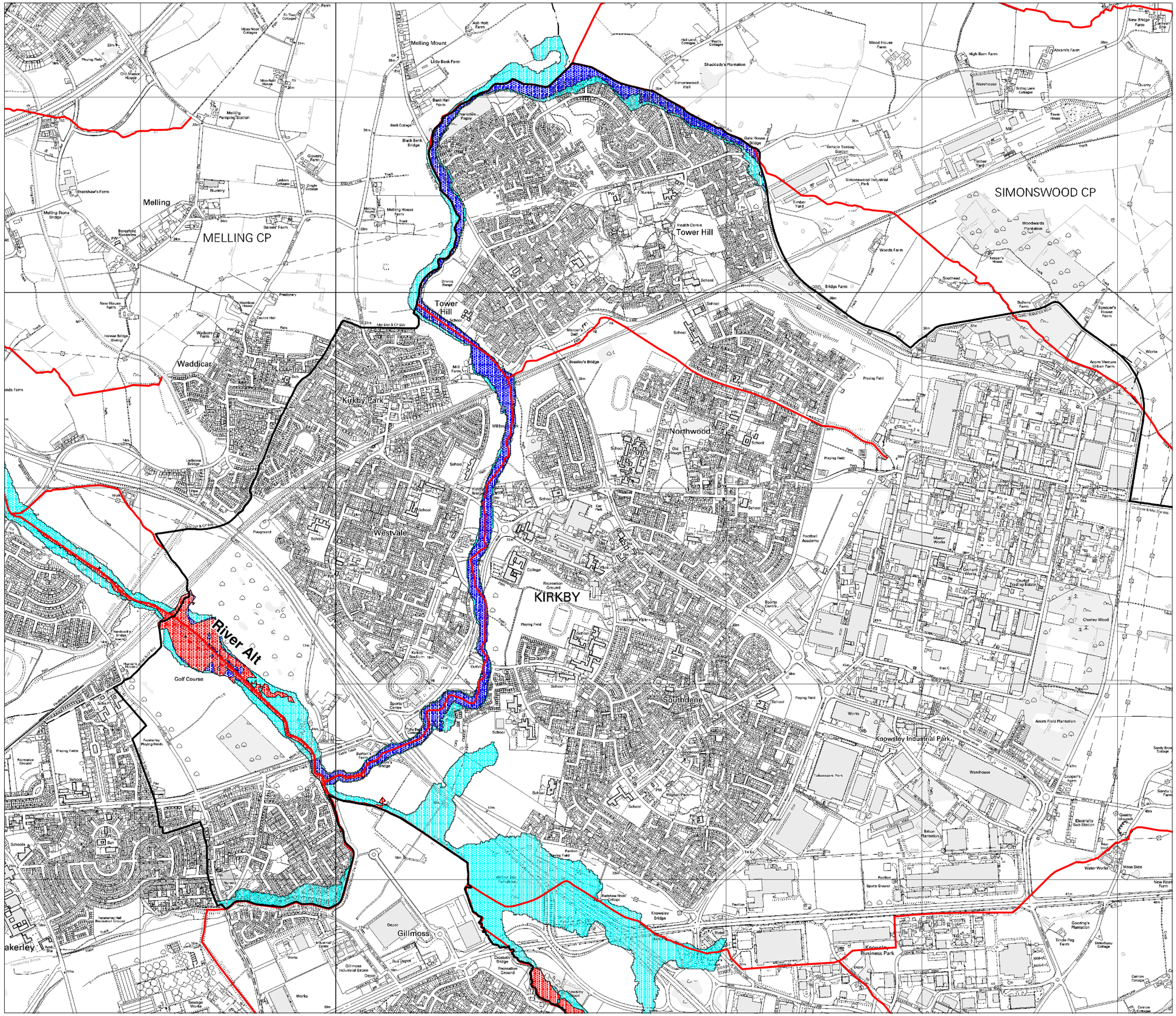
Figure Title:

PPS25 Updated Flood Zones
Knowsley Overview

Document Reference:	Figure Number:
5074164/62/DG/002	**F1-1**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

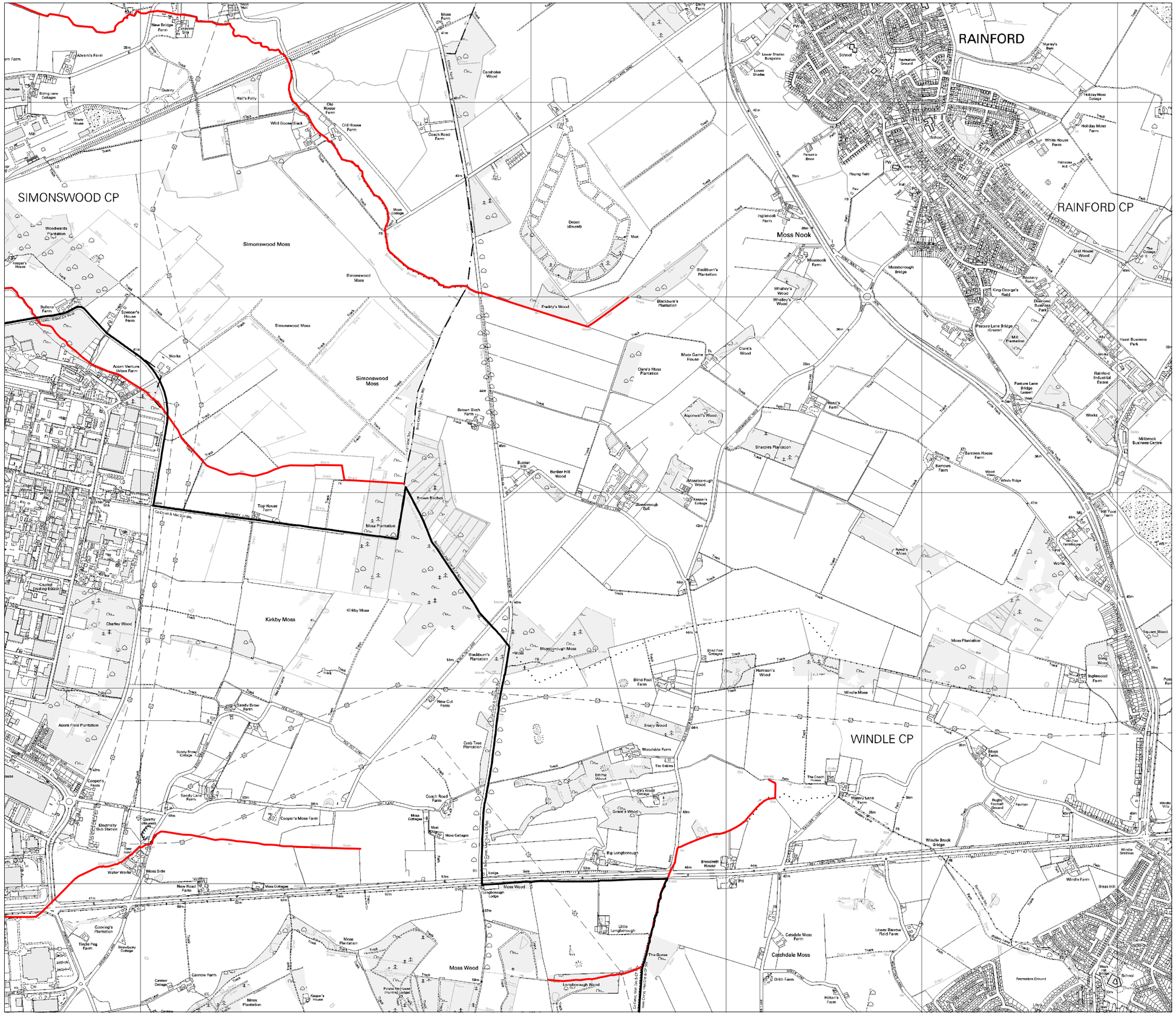
PPS25 Updated Flood Zones
Knowsley 1

Document Reference: **5074164/62/DG/002**

Figure Number: **F1-2**

Knowsley Council

ATKINS



Legend:

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

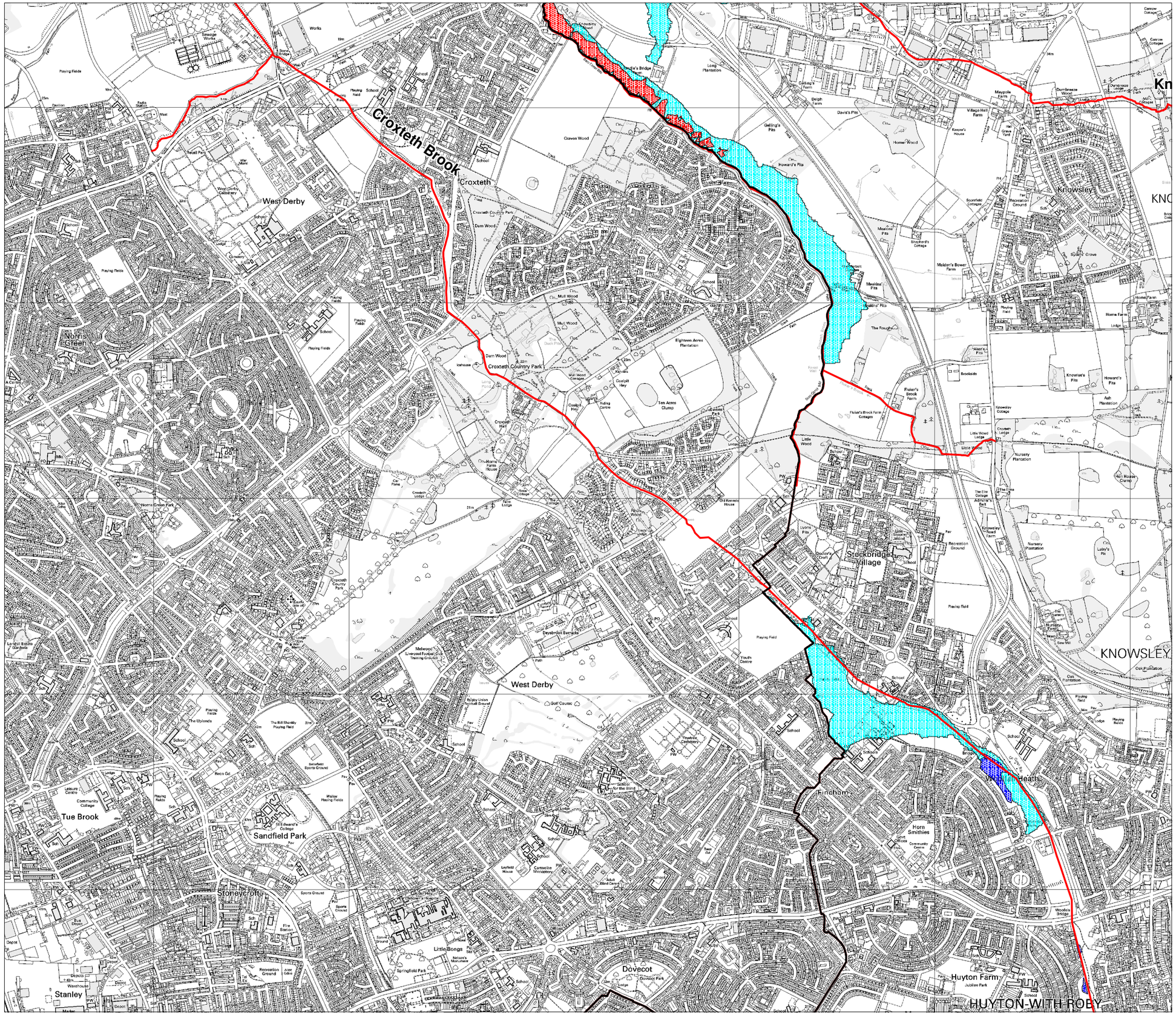
PPS25 Updated Flood Zones
Knowsley 2

Document Reference: **5074164/62/DG/002**

Figure Number: **F1-3**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

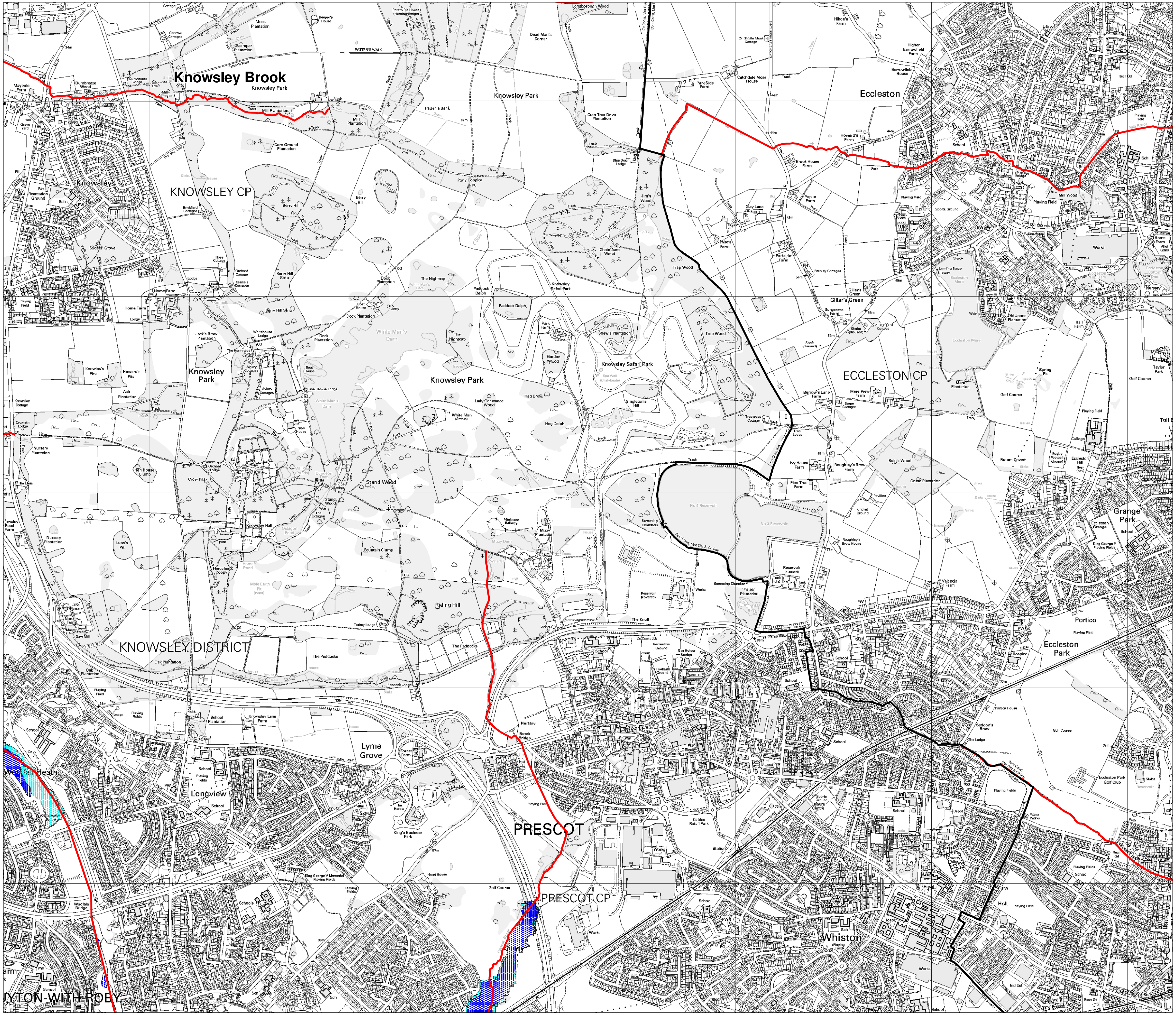
PPS25 Updated Flood Zones
Knowsley 3

Document Reference: **5074164/62/DG/002**

Figure Number: **F1-4**

Knowsley Council

ATKINS



Legend:

Knowsley Boundary

Watercourse

Flood Zone 3b

Flood Zone 3a

Flood Zone 2

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

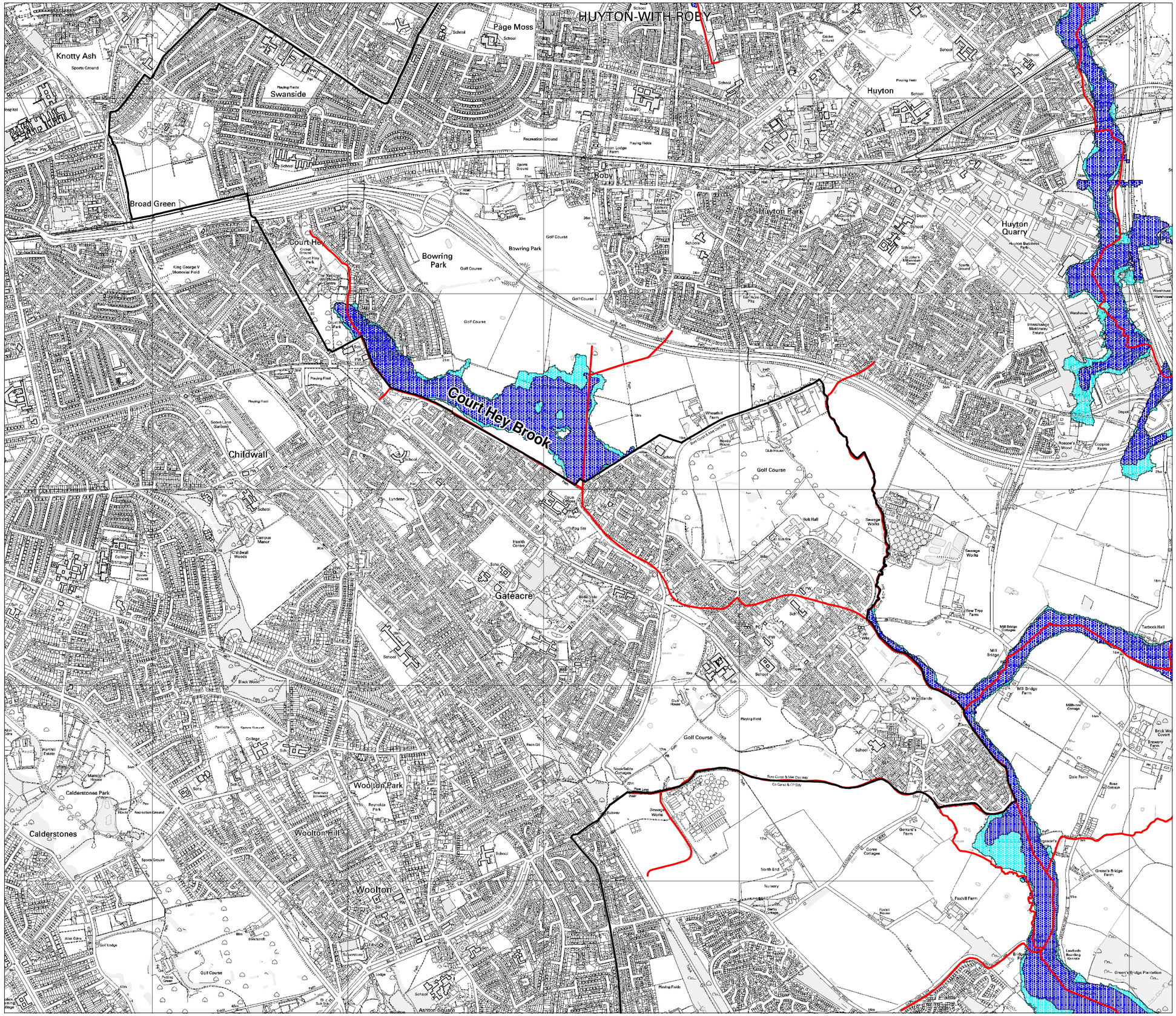
Figure Title:

PPS25 Updated Flood Zones
Knowsley 4

Document Reference:	Figure Number:
5074164/62/DG/002	**F1-5**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

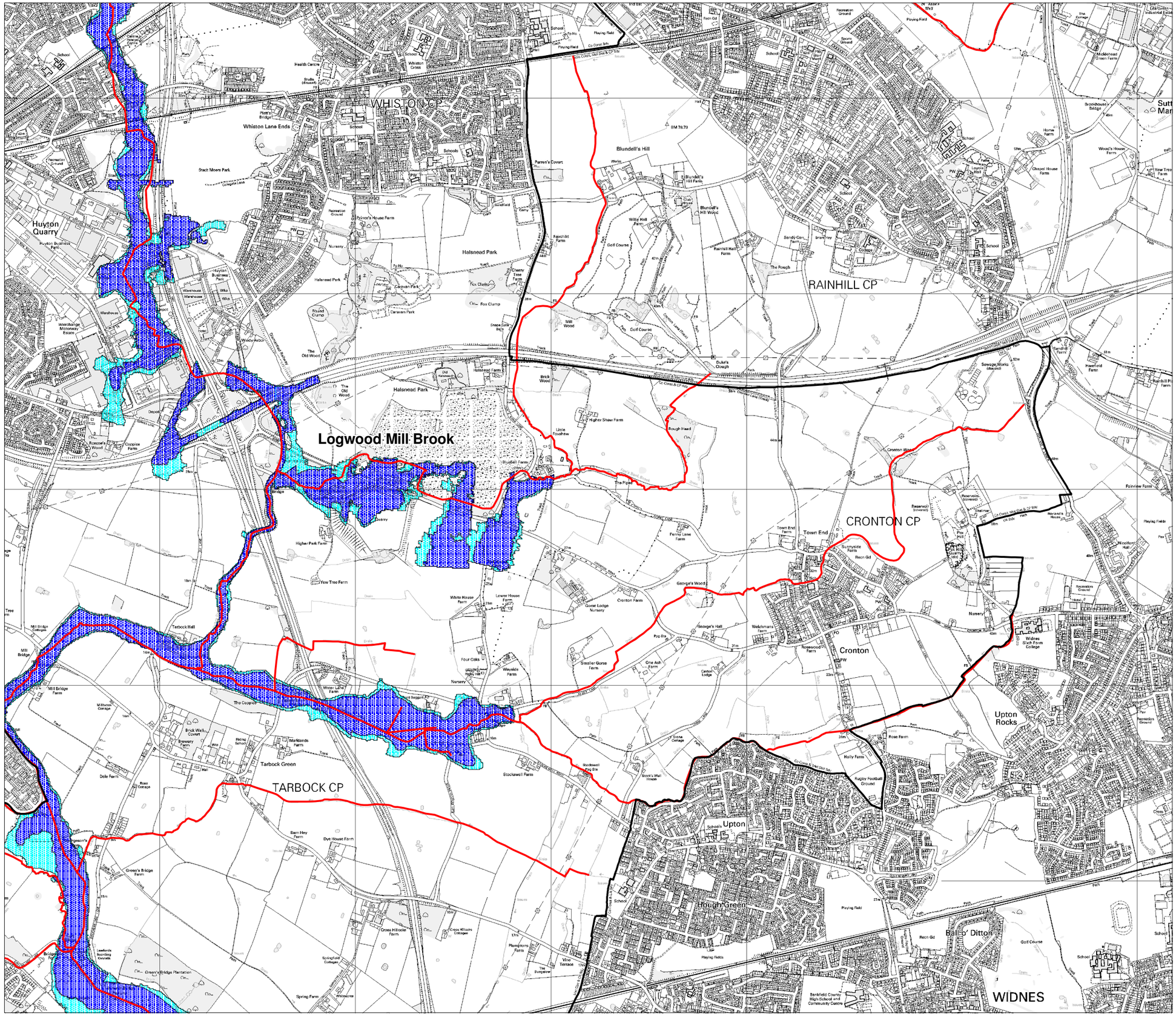
PPS25 Updated Flood Zones
Knowsley 5

Document Reference: **5074164/62/DG/002**

Figure Number: **F1-6**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

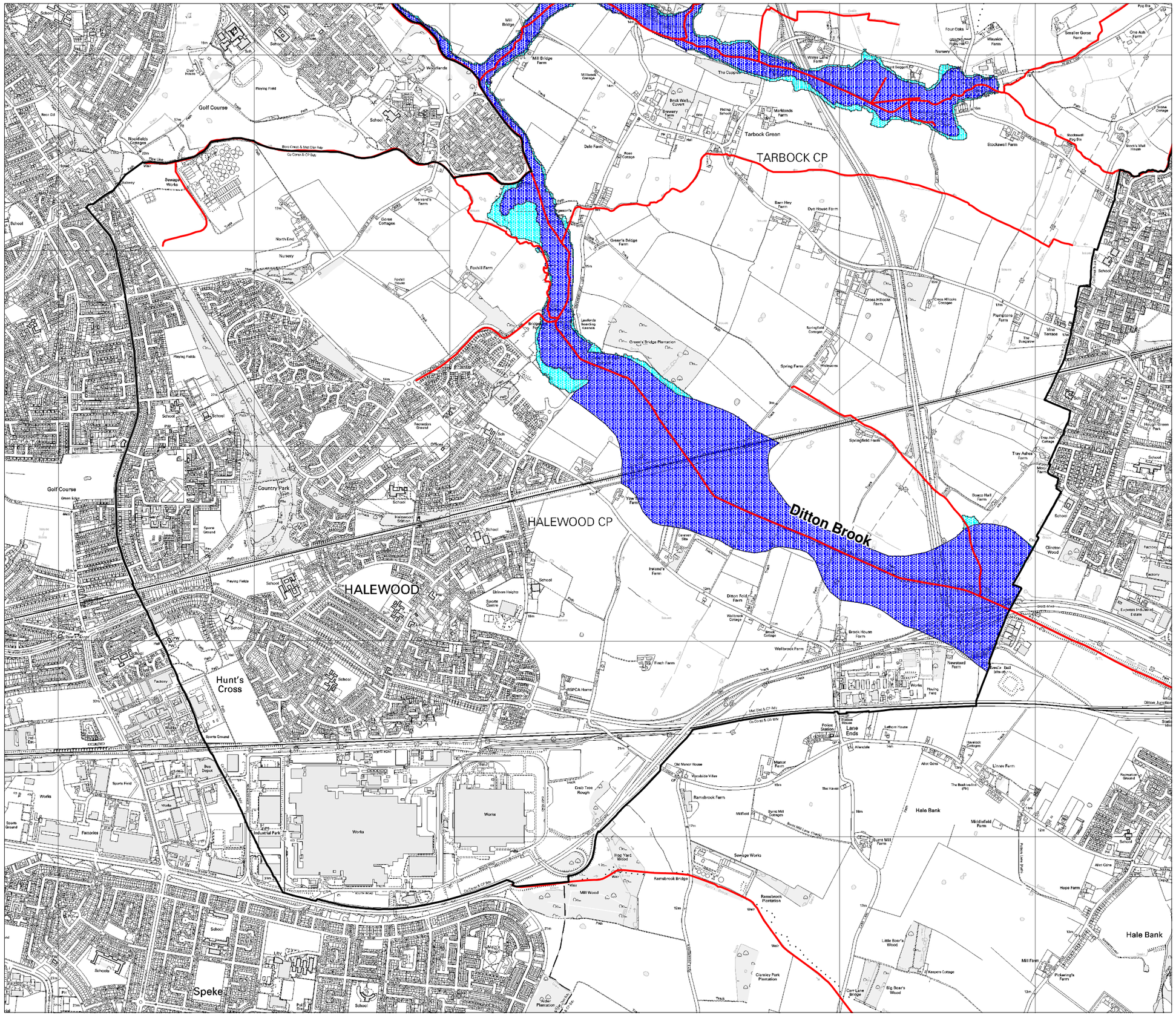
PPS25 Updated Flood Zones
Knowsley 6

Document Reference: **5074164/62/DG/002**

Figure Number: **F1-7**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

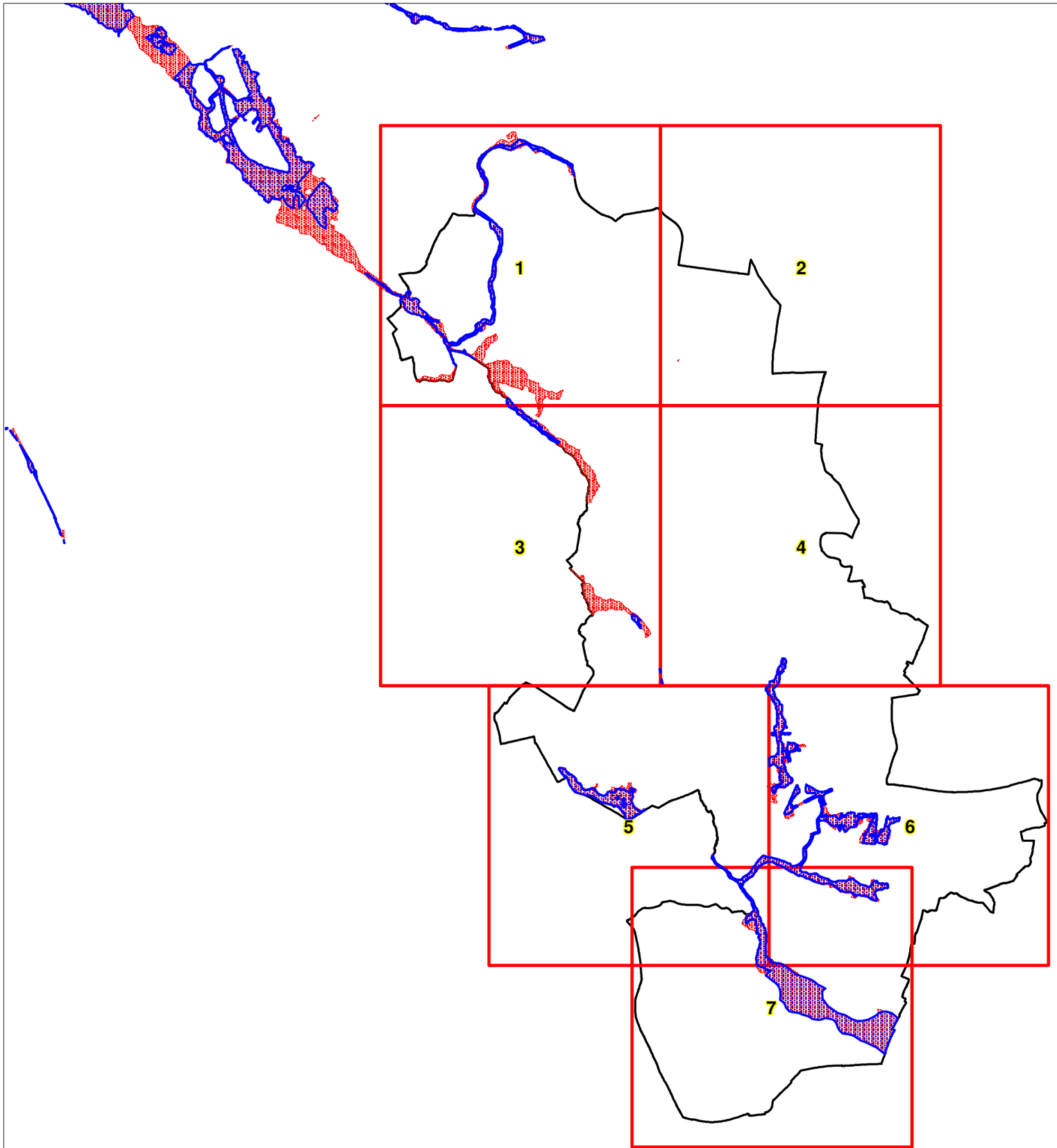
PPS25 Updated Flood Zones
Knowsley 7

Document Reference: **5074164/62/DG/002**

Figure Number: **F1-8**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3a - Current Respresentation of 1% AEP event
- Flood Zone 3a with Climate Change - Representation of 1% AEP event with climate change

N.B. In the absence of bespoke modelling data for climate change and in line with Environment Agency advice the outline used to represent the 1% AEP (1 in 100 year) event is based upon the Environment Agency Flood Map 2 (1 in 1000 year) outline.
This work estimates the flood outline in the year 2050, but due to the absence of bespoke modelling, the results are conservative.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

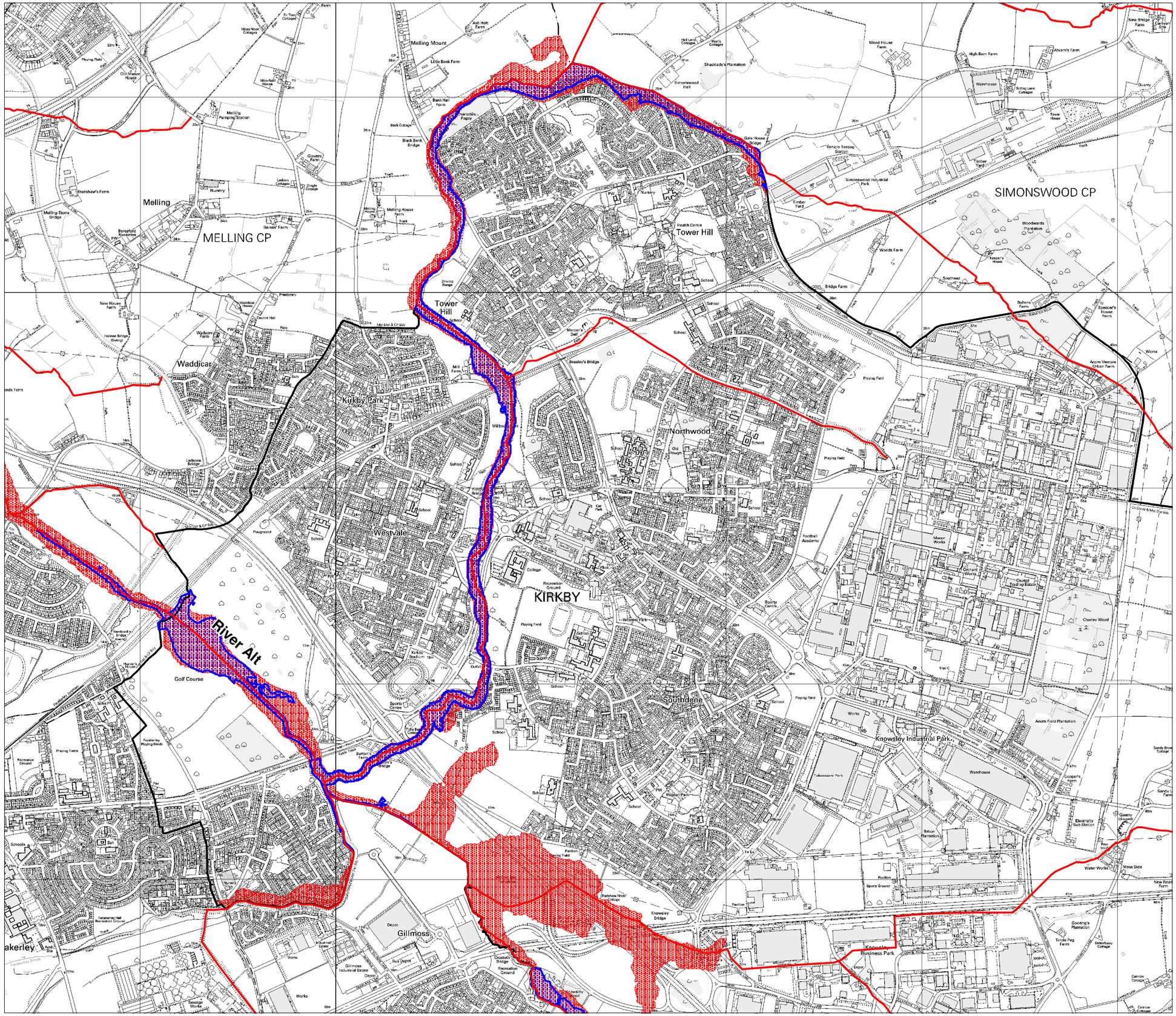
Figure Title:

PPS25 Flood Zone 3a with Climate Change
Knowsley Overview

Document Reference:	Figure Number:
50741464/62/DG/002	**G1-1**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3a - Current Respresentation of 1% AEP event
- Flood Zone 3a with Climate Change - Representation of 1% AEP event with climate change

N.B. In the absence of bespoke modelling data for climate change and in line with Environment Agency advice the outline used to represent the 1% AEP (1 in 100 year) event is based upon the Environment Agency Flood Map 2 (1 in 1000 year) outline.
This work estimates the flood outline in the year 2050, but due to the absence of bespoke modelling, the results are conservative.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

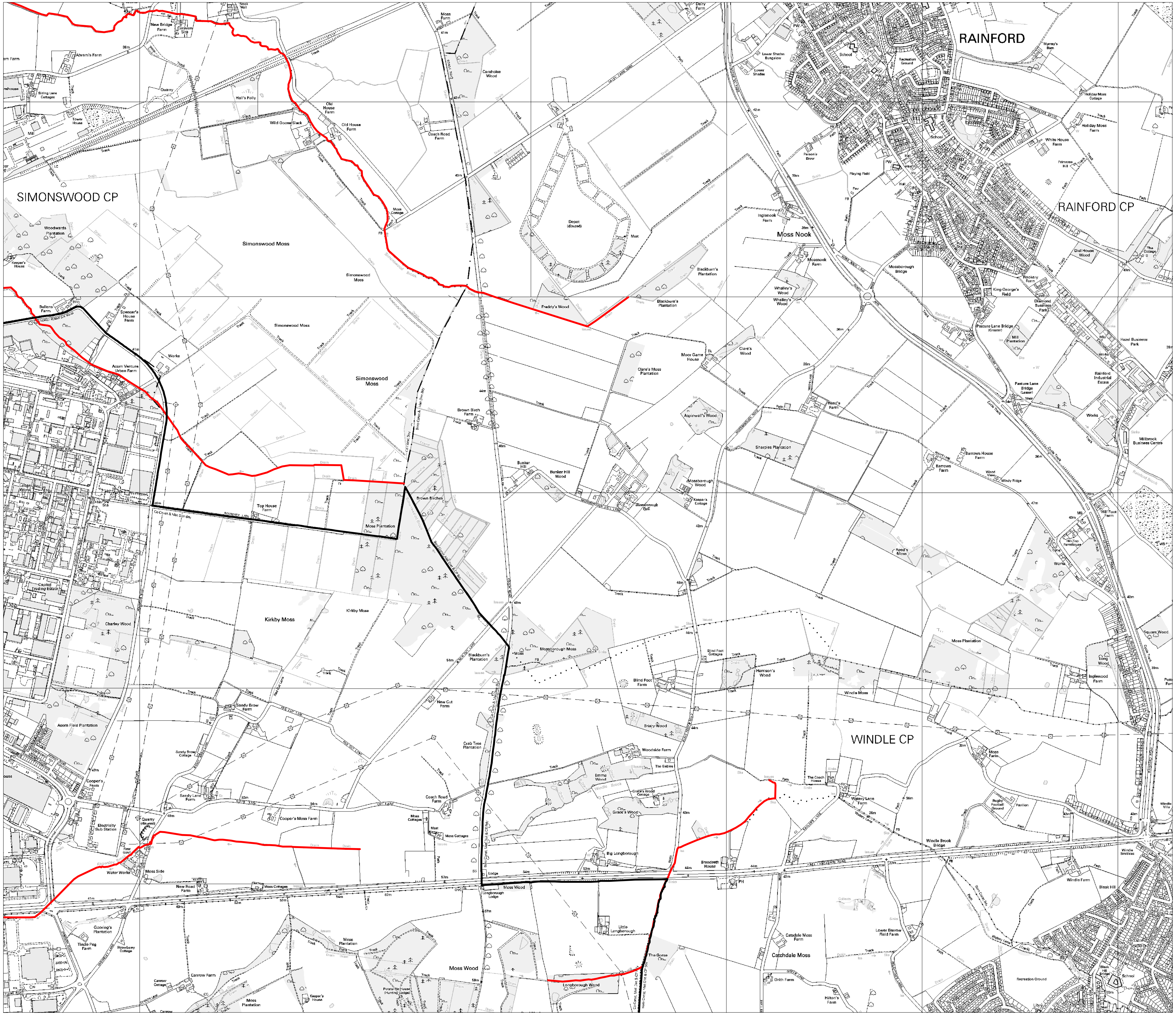
Figure Title:

PPS25 Flood Zone 3a with Climate Change
Knowsley 1

Document Reference:	Figure Number:
50741464/62/DG/002	**G1-2**

Knowsley Council

ATKINS



Legend:

Knowsley Boundary

Watercourse

Flood Zone 3a - Current Respresentation of 1% AEP event

Flood Zone 3a with Climate Change - Representation of 1% AEP event with climate change

N.B. In the absence of bespoke modelling data for climate change and in line with Environment Agency advice the outline used to represent the 1% AEP (1 in 100 year) event is based upon the Environment Agency Flood Map 2 (1 in 1000 year) outline.
This work estimates the flood outline in the year 2050, but due to the absence of bespoke modelling, the results are conservative.

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

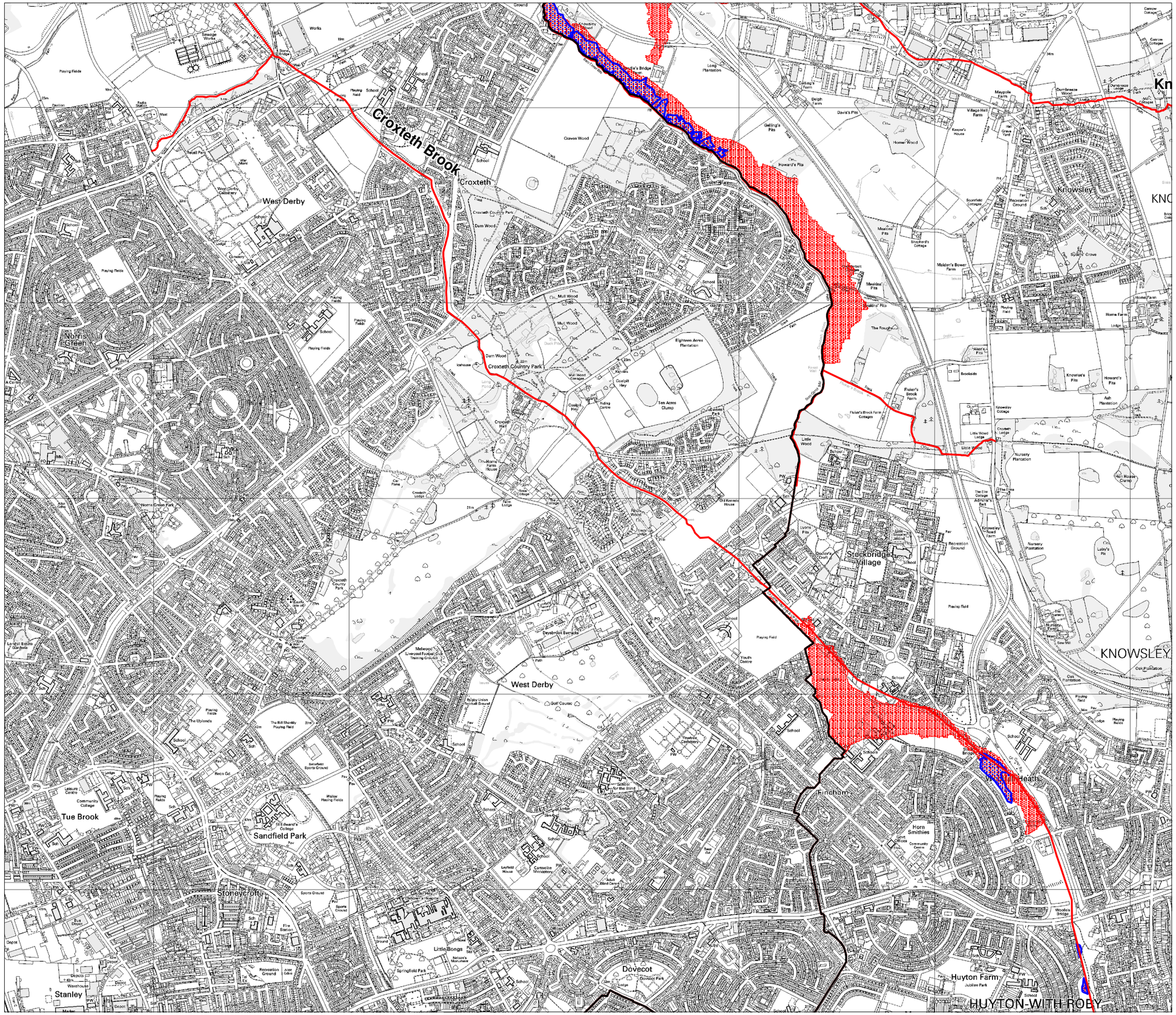
PPS25 Flood Zone 3a with Climate Change Knowsley 2

Document Reference: **50741464/62/DG/002**

Figure Number: **G1-3**

Knowsl@y Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3a - Current Respresentation of 1% AEP event
- Flood Zone 3a with Climate Change - Representation of 1% AEP event with climate change

N.B. In the absence of bespoke modelling data for climate change and in line with Environment Agency advice the outline used to represent the 1% AEP (1 in 100 year) event is based upon the Environment Agency Flood Map 2 (1 in 1000 year) outline.
This work estimates the flood outline in the year 2050, but due to the absence of bespoke modelling, the results are conservative.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

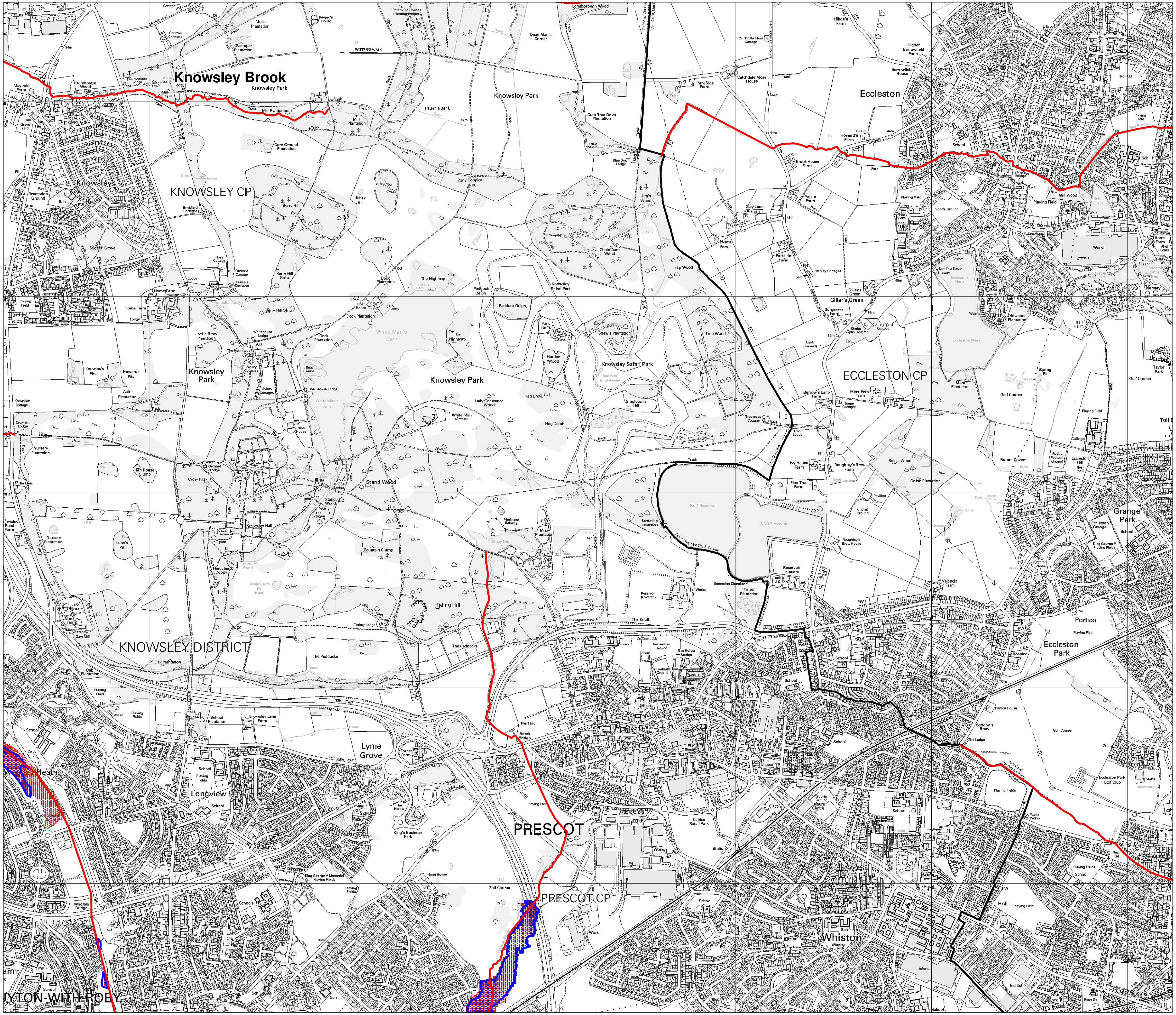
PPS25 Flood Zone 3a with Climate Change
Knowsley 3

Document Reference: **50741464/62/DG/002**

Figure Number: **G1-4**

Knowsley Council

ATKINS



Legend:

Knowsley Boundary

Watercourse

Flood Zone 3a - Current Respresentation of 1% AEP event

Flood Zone 3a with Climate Change - Representation of 1% AEP event with climate change

N.B. In the absence of bespoke modelling data for climate change and in line with Environment Agency advice the outline used to represent the 1% AEP (1 in 100 year) event is based upon the Environment Agency Flood Map 2 (1 in 1000 year) outline.
This work estimates the flood outline in the year 2050, but due to the absence of bespoke modelling, the results are conservative.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

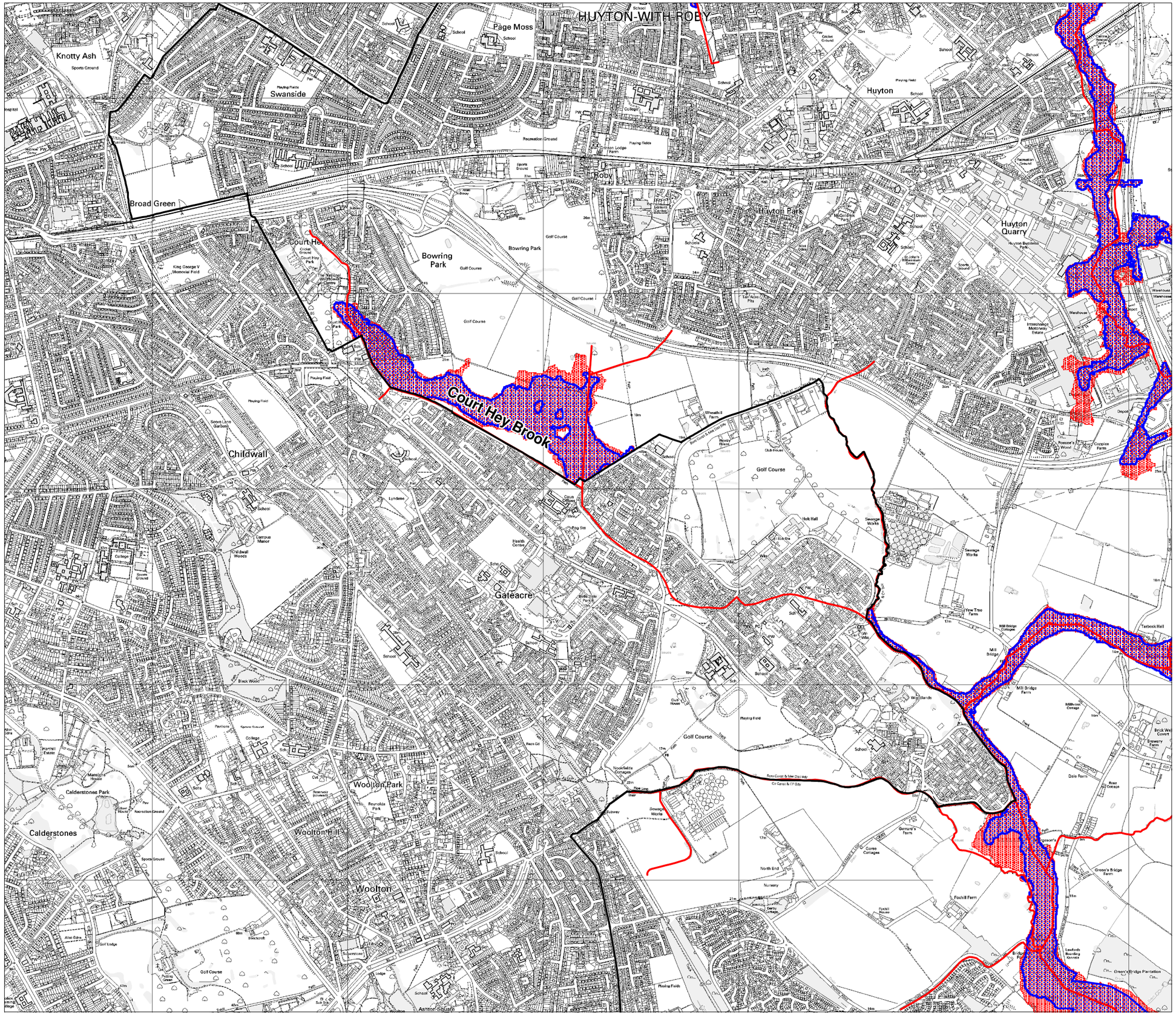
PPS25 Flood Zone 3a with Climate Change
Knowsley 4

Document Reference: **50741464/62/DG/002**

Figure Number: **G1-5**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3a - Current Respresentation of 1% AEP event
- Flood Zone 3a with Climate Change - Representation of 1% AEP event with climate change

N.B. In the absence of bespoke modelling data for climate change and in line with Environment Agency advice the outline used to represent the 1% AEP (1 in 100 year) event is based upon the Environment Agency Flood Map 2 (1 in 1000 year) outline.
This work estimates the flood outline in the year 2050, but due to the absence of bespoke modelling, the results are conservative.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

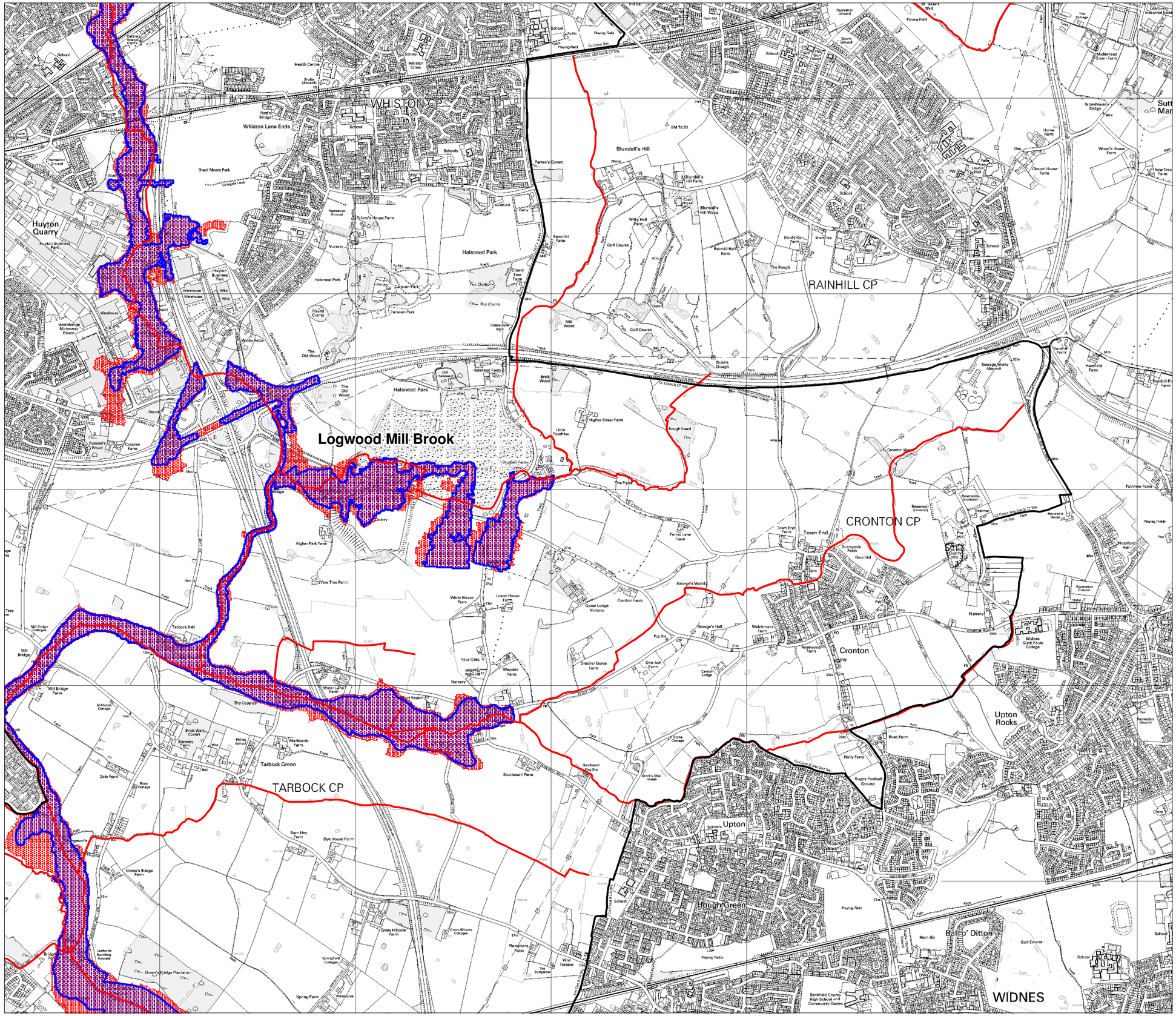
Figure Title:

PPS25 Flood Zone 3a with Climate Change
Knowsley 5

Document Reference:	Figure Number:
50741464/62/DG/002	**G1-6**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3a - Current Respresentation of 1% AEP event
- Flood Zone 3a with Climate Change - Representation of 1% AEP event with climate change

N.B. In the absence of bespoke modelling data for climate change and in line with Environment Agency advice the outline used to represent the 1% AEP (1 in 100 year) event is based upon the Environment Agency Flood Map 2 (1 in 1000 year) outline.
This work estimates the flood outline in the year 2050, but due to the absence of bespoke modelling, the results are conservative.

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

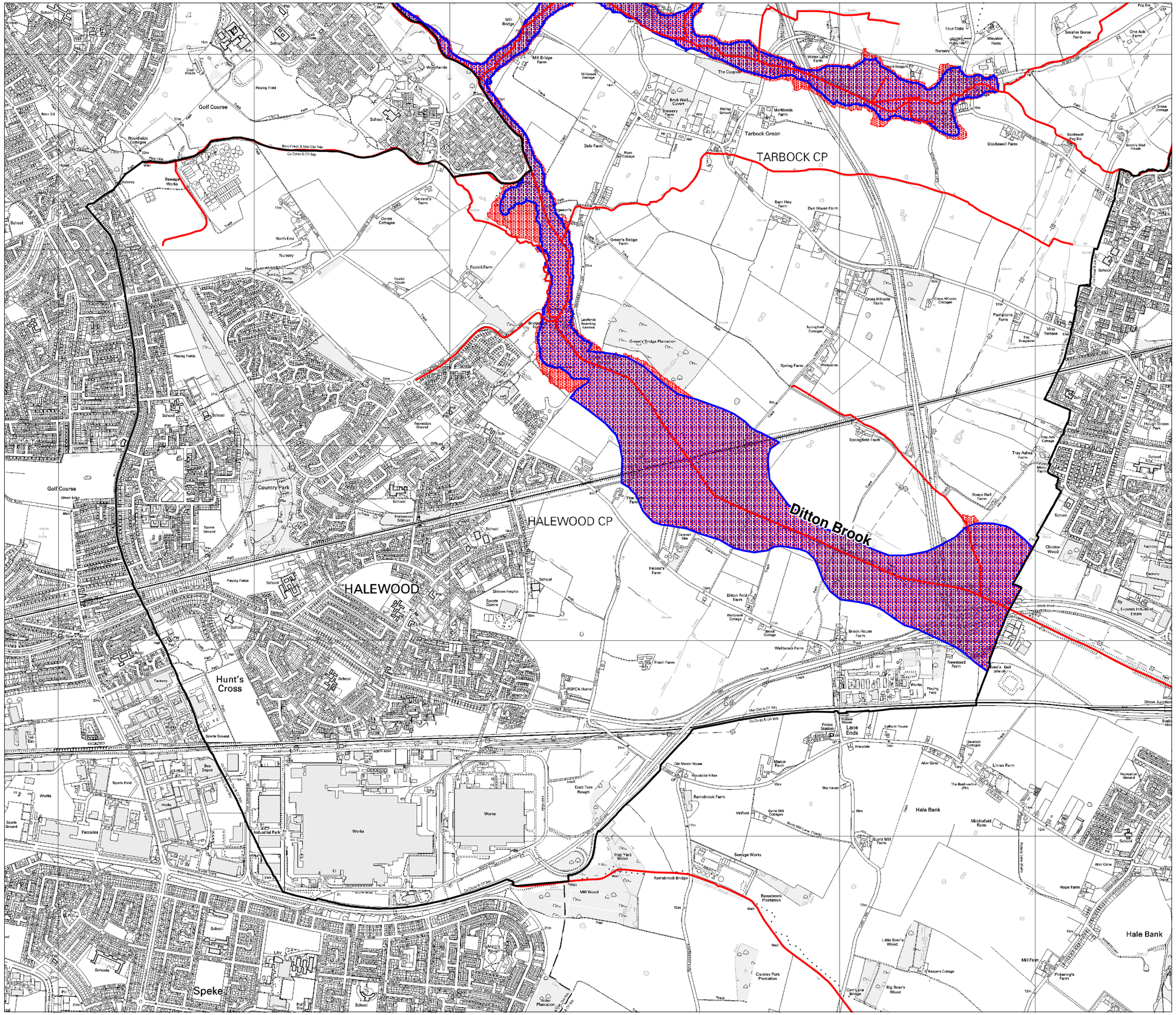
PPS25 Flood Zone 3a with Climate Change
Knowsley 6

Document Reference: **50741464/62/DG/002**

Figure Number: **G1-7**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3a - Current Respresentation of 1% AEP event
- Flood Zone 3a with Climate Change - Representation of 1% AEP event with climate change

N.B. In the absence of bespoke modelling data for climate change and in line with Environment Agency advice the outline used to represent the 1% AEP (1 in 100 year) event is based upon the Environment Agency Flood Map 2 (1 in 1000 year) outline.
This work estimates the flood outline in the year 2050, but due to the absence of bespoke modelling, the results are conservative.

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

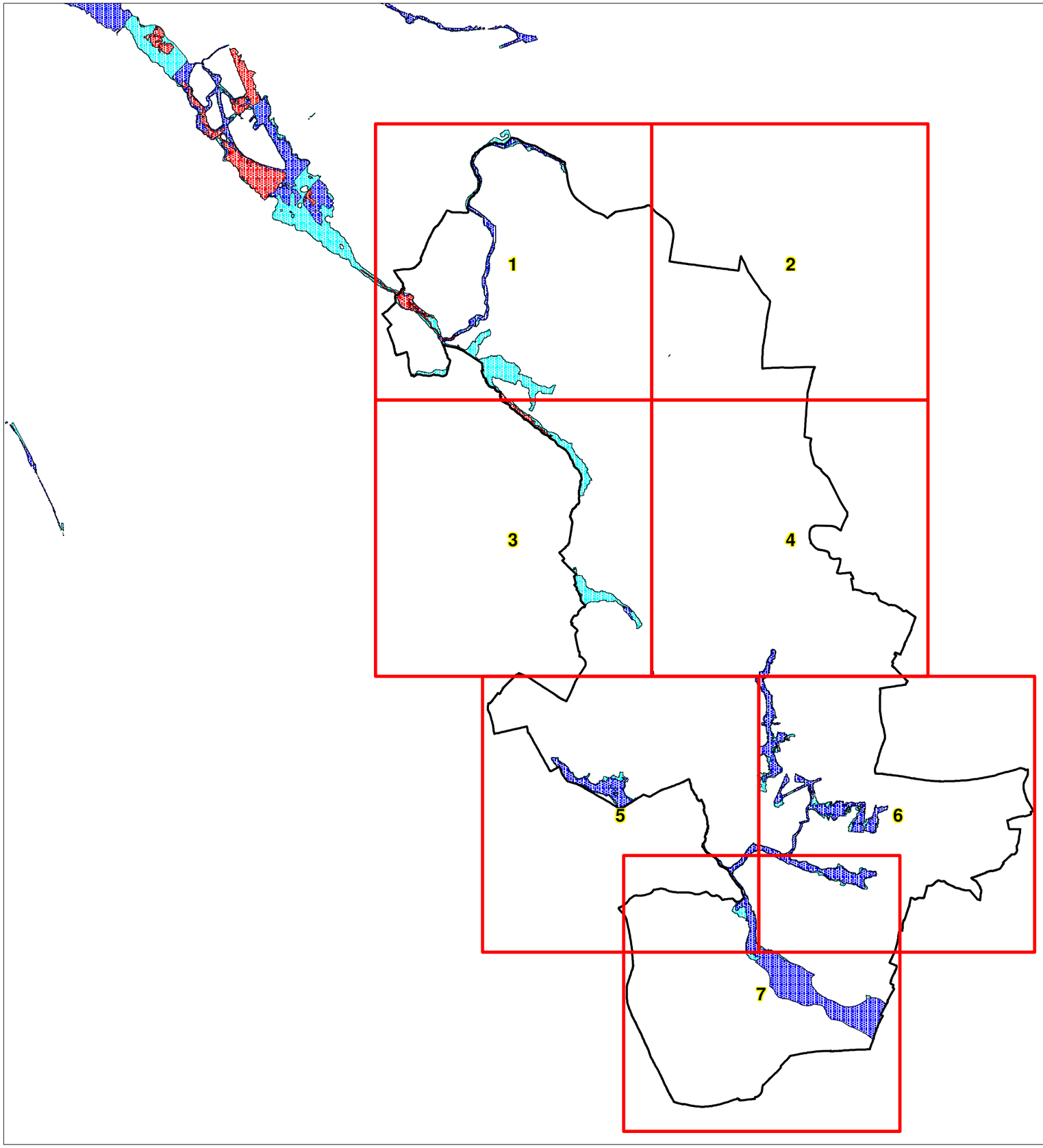
PPS25 Flood Zone 3a with Climate Change Knowsley 7

Document Reference: **50741464/62/DG/002**

Figure Number: **G1-8**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Land Allocations

- Housing Development
- Transport
- Action Areas
- The Economy

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

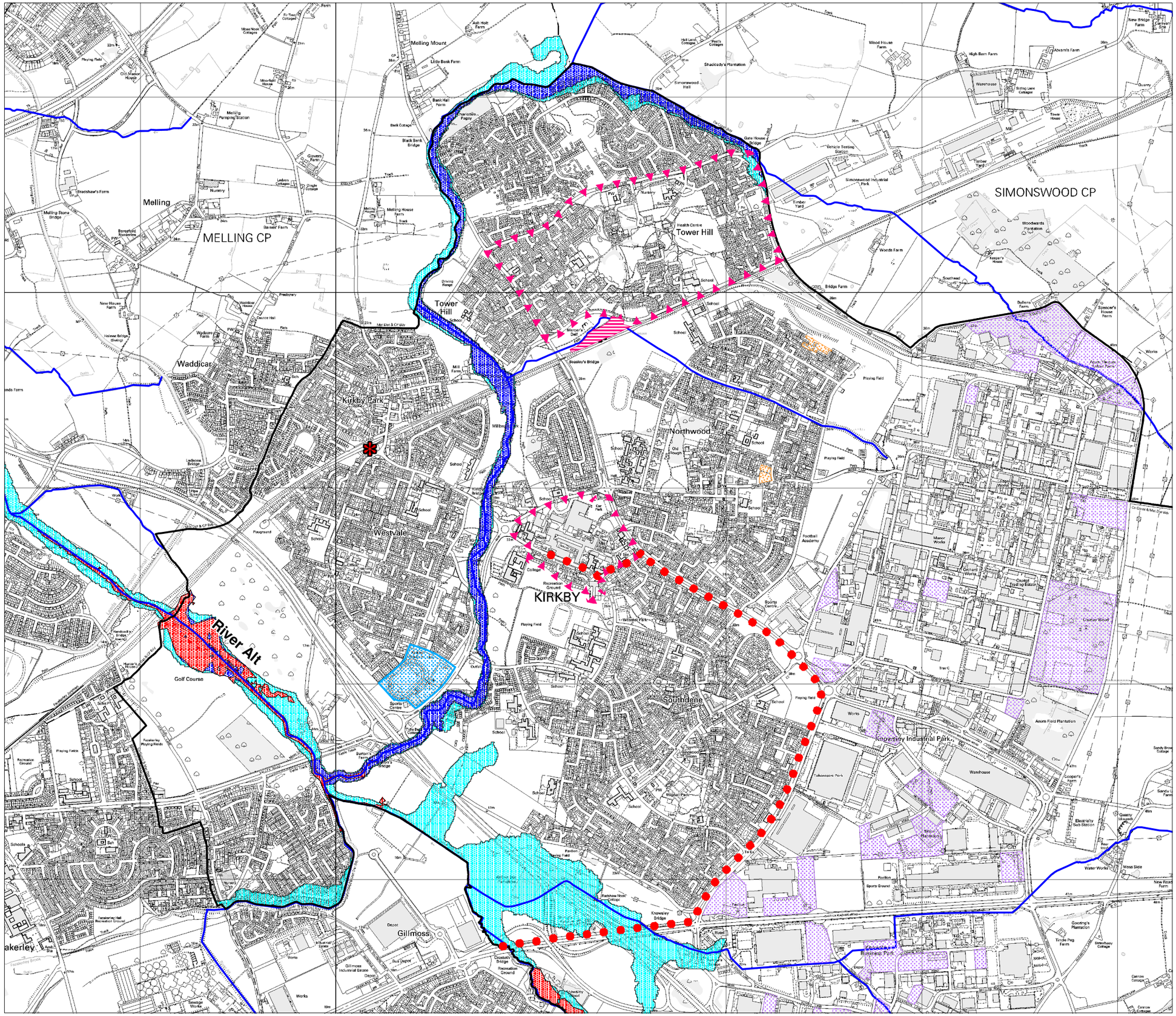
Identified Development Sites and PPS25 Flood Zones
Knowsley Overview

Document Reference: **5074164/62/DG/002**

Figure Number: **H1-1**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Land Allocations

- Housing Development
- Transport
- Action Areas
- The Economy

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

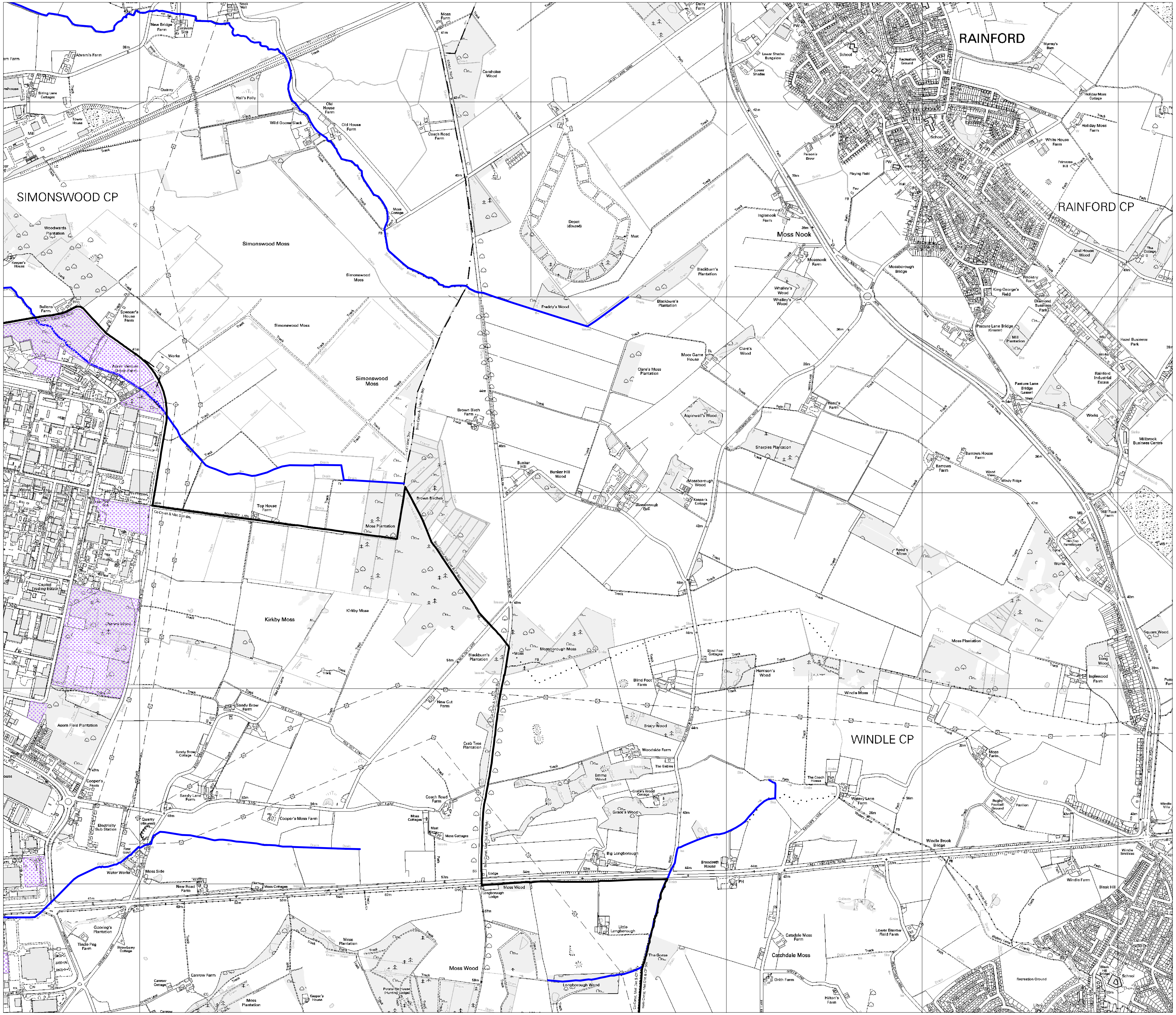
Identified Development Sites and PPS25 Flood Zones
Knowsley 1

Document Reference: **5074164/62/DG/002**

Figure Number: **H1-2**

Knowsley Council

ATKINS



Legend:

Knowsley Boundary

Watercourse

Flood Zone 3b

Flood Zone 3a

Flood Zone 2

Land Allocations

Housing Development

Transport

Action Areas

The Economy

SCALE: NTS

Project Title:

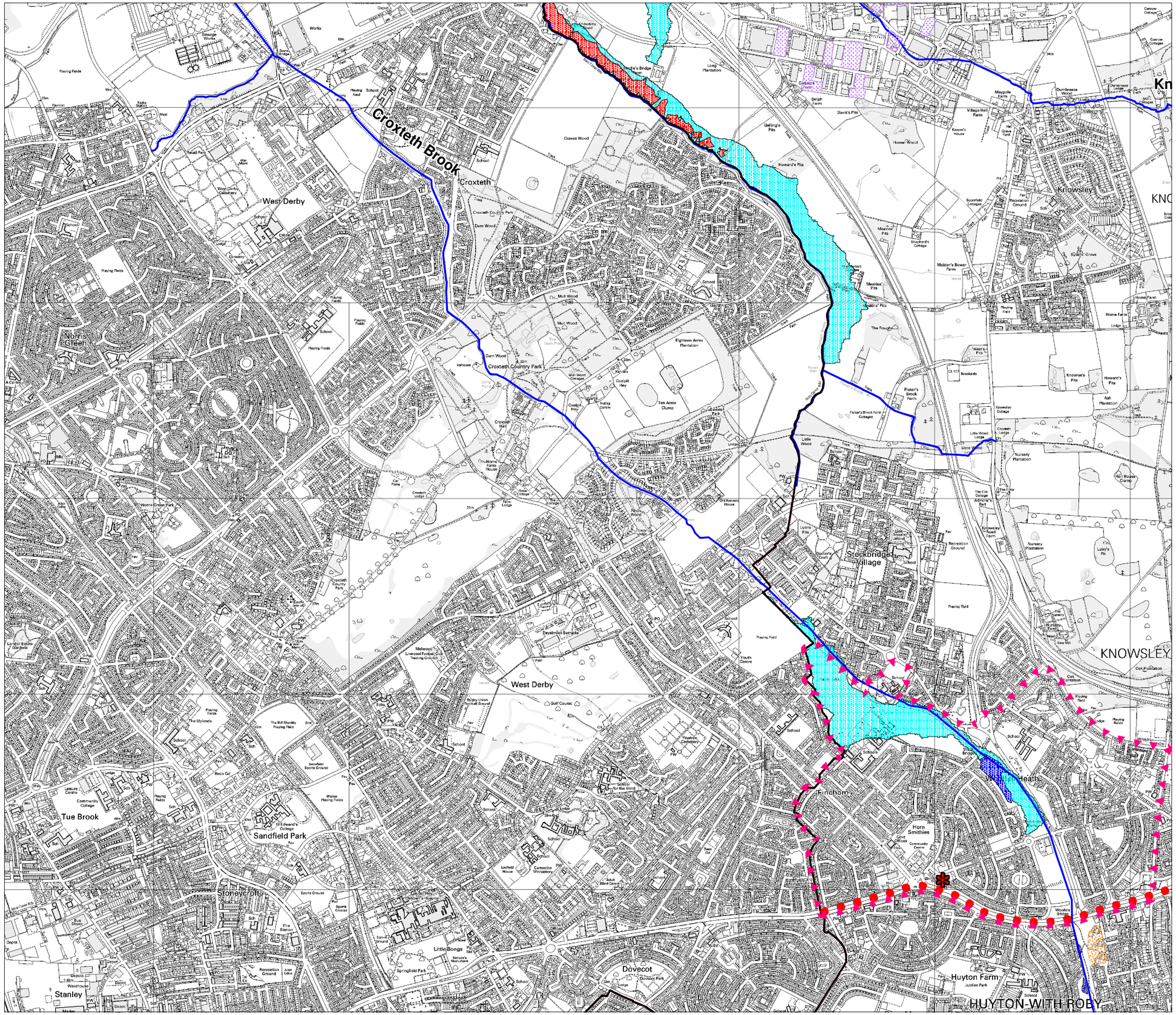
Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

Identified Development Sites and PPS25
Flood Zones
Knowsley 2

Document Reference: **5074164/62/DG/002**

Figure Number: **H1-3**



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Land Allocations

- Housing Development
- Transport
- Action Areas
- The Economy

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

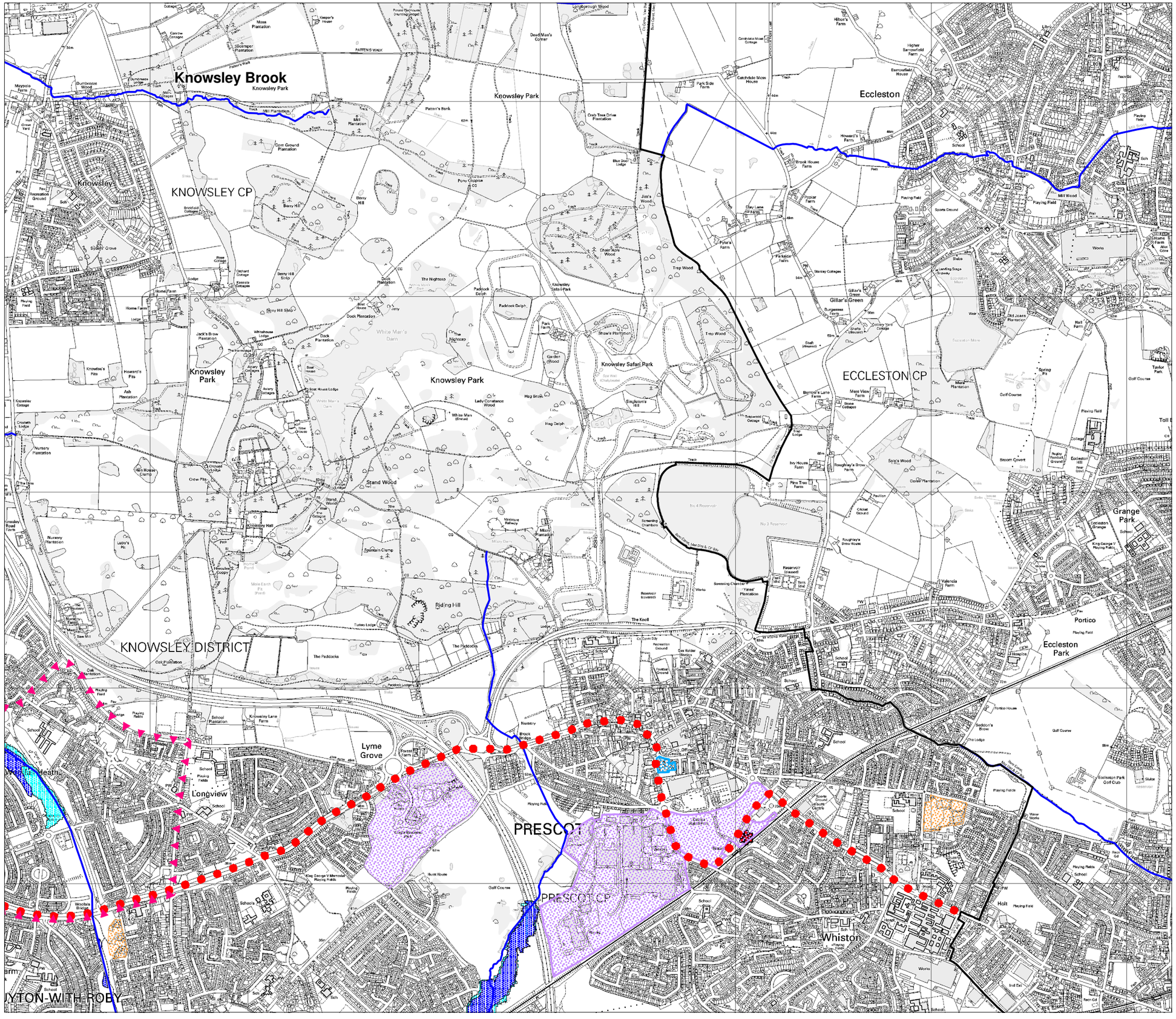
Identified Development Sites and PPS25 Flood Zones
Knowsley 3

Document Reference: **5074164/62/DG/002**

Figure Number: **H1-4**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Land Allocations

- Housing Development
- Transport
- Action Areas
- The Economy

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

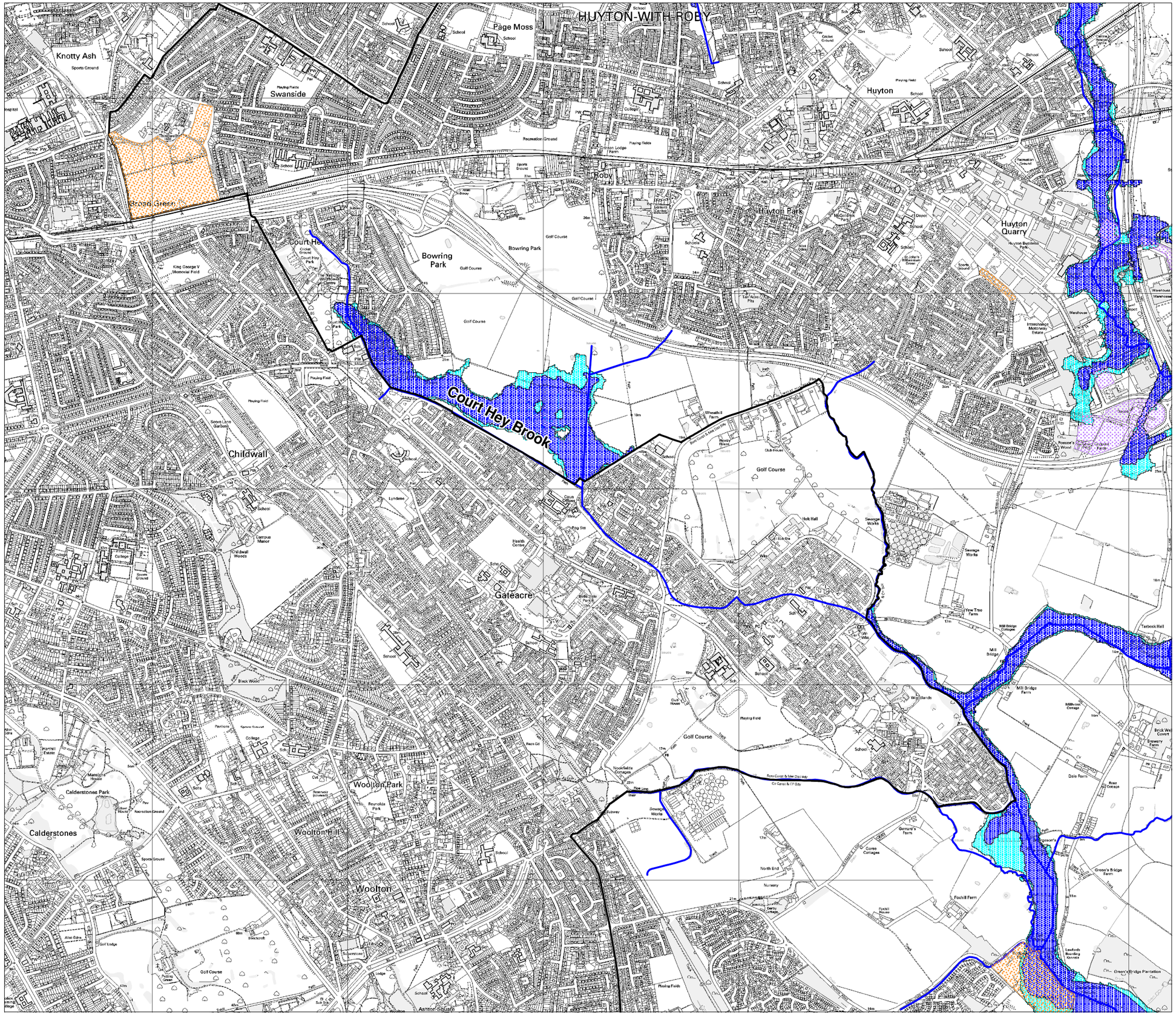
Identified Development Sites and PPS25 Flood Zones
Knowsley 4

Document Reference: **5074164/62/DG/002**

Figure Number: **H1-5**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Land Allocations

- Housing Development
- Transport
- Action Areas
- The Economy

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

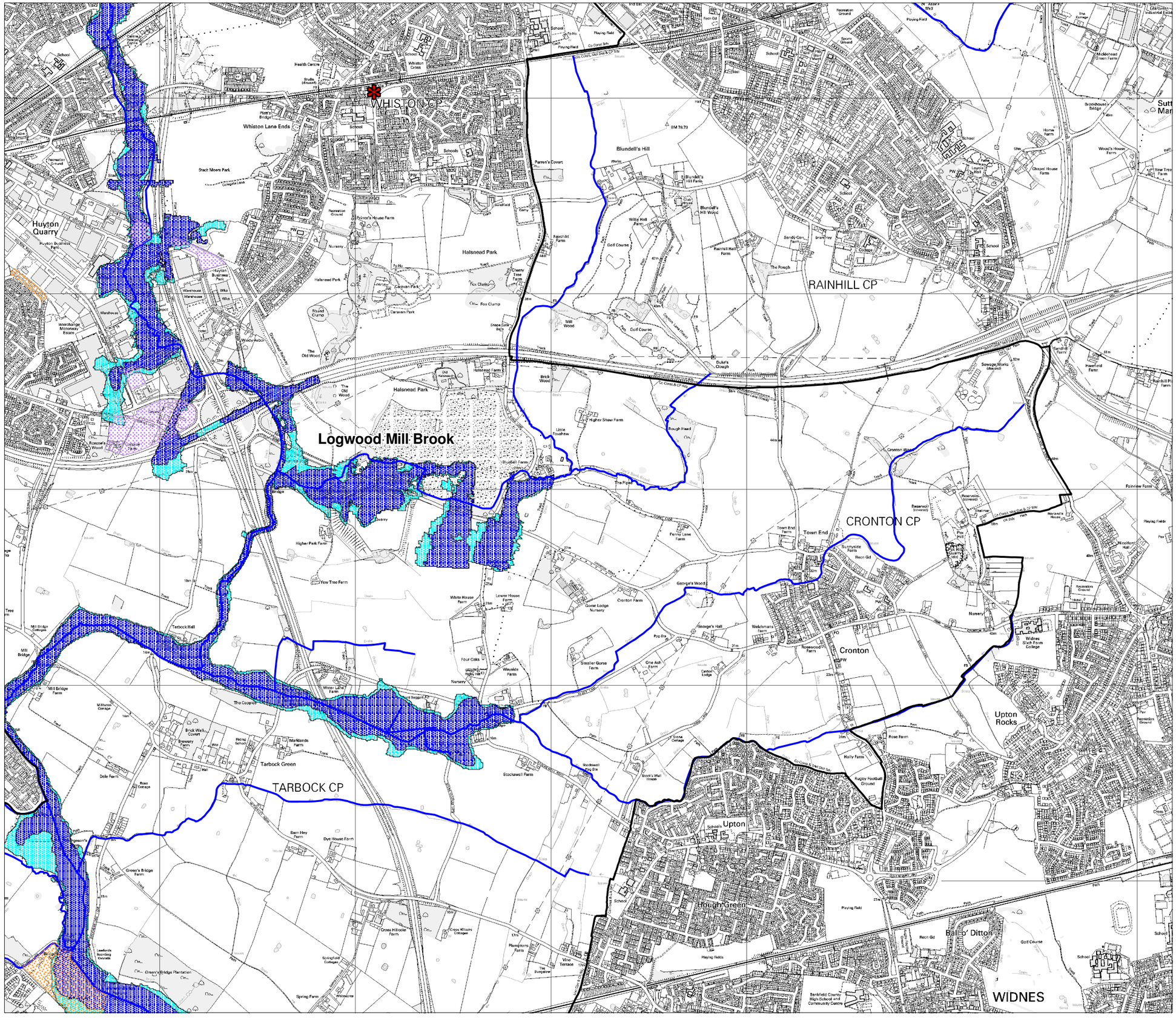
Identified Development Sites and PPS25 Flood Zones
Knowsley 5

Document Reference: **5074164/62/DG/002**

Figure Number: **H1-6**

Knowsley Council

ATKINS



Legend:

- Knowsley Boundary
- Watercourse
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

Land Allocations

- Housing Development
- Transport
- Action Areas
- The Economy

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

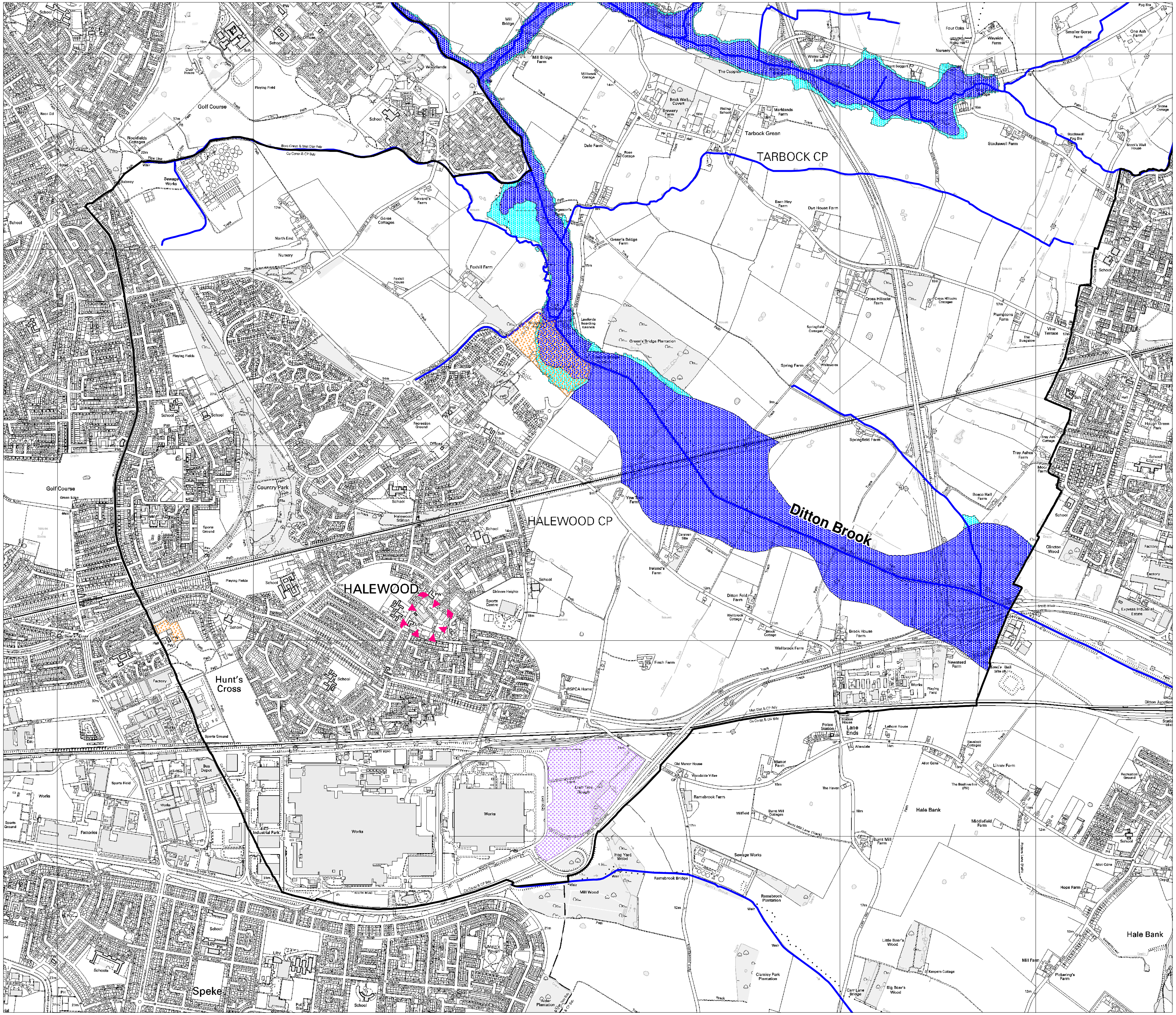
Figure Title:

Identified Development Sites and PPS25
Flood Zones
Knowsley 6

Document Reference:	Figure Number:
5074164/62/DG/002	**H1-7**

Knowsley Council

ATKINS



Legend:

□	Knowsley Boundary
—	Watercourse
▨	Flood Zone 3b
▨	Flood Zone 3a
▨	Flood Zone 2

Land Allocations

▨	Housing Development
—	Transport
▨	Action Areas
▨	The Economy

SCALE: NTS

Project Title:

Knowsley and Sefton
Strategic Flood Risk Assessment

Figure Title:

Identified Development Sites and PPS25
Flood Zones
Knowsley 7

Document Reference: **5074164/62/DG/002**

Figure Number: **H1-8**

Knowsley Council

ATKINS

I. Sequential Test Results

I.1 Site Specific Results – Knowsley Council

Knowsley Council has identified which sites have been allocated for development. The Sequential Test has been applied to each of these sites and their associated land uses and resulted in the following 3 groupings:

1. Sites where proposed land use is appropriate
2. Sites which require application of the Exception Test
3. Sites where the intended land use is not appropriate

It should be noted that the Flood Zone attributed to the allocation site represents the 'worst case' as prescribed by PPS25. No consideration is given to the proportions of the site within each floodplain which, at a site specific level of detail, may actually provide the required area for development outside of the 'worst case' Flood Zone. Appendix C provides a table of the proportions of each site that are within each Flood Zone classification, this information supports the following site specific comments.

I.1.1 Housing Development

Residential dwellings are categorised to have a Flood Risk Vulnerability Index of 'More Vulnerable' and therefore, according to Table D.3 of PPS25, they are considered appropriate for development in either Flood Zone 1 or Flood Zone 2, require an Exception Test if proposed within Flood Zone 3a and inappropriate for Flood Zone 3b.

Of the 8 housing development sites, the following 7 sites are considered appropriate for housing development:

Table I1.

Site Ref	Location	Area (Hectares)	FZ1	FZ2
H2	Former flats at 62-100 Kipling Avenue, Huyton	0.7	Yes	-
H3	Former Wingate Towers site, Alamein Road, Huyton	1.5	Yes	-
H4	Land at Thingwall Lane, Huyton	17.8	Yes	-
H5	Land adjacent to St Andrew's Church Hall, Boundary Drive, Halewood	0.8	Yes	-
H6	Quarryside Drive, Kirby	0.5	Yes	-
H7	Land at Delph Lane/Two Butt Lane, Whiston	3	Yes	-
H8	Trecastle Road, Kirby	0.6	Yes	-

As previously discussed, due to the unavailability of Functional Floodplain data for some locations within the Council area, it has not been possible to categorically determine whether some of the allocated sites are located within Flood Zone 3a or 3b. The following housing development site at Halewood has been identified as lying within Flood Zone 3a and potentially within Flood Zone 3b.

Table I2

Site Ref	Location	Area (Hectares)	FZ3a	FZ3b	Potential FZ3b
H1	Former Bridgefield Forum site, Cartbridge Lane, Halewood	8.3	Yes	-	Yes

As this site is within Flood Zone 3a it requires an Exception Test to be undertaken with a site specific FRA at some stage. Prior to this, an alternative site should be sought which has a less vulnerable land use proposed and a lower flood risk classification; this may provide a potential alternative site.

It is recognised however that of the total site area 49.4% of the site is located within Flood Zone 3a. It may, therefore, be possible to plan the site where housing development takes place in the area of the site within Flood Zone 1 and 2, allowing the areas of Flood Zone 3a and 3b to be used for more appropriate Water compatible usage such as public open space. These investigations should be completed within a site specific FRA.

Future proposals for this site should be considered in conjunction with further information on the Functional Floodplain, once available, as part of a site specific FRA.

I.1.2 Action Areas and Opportunity Sites

The Action Areas and Opportunity sites classification contains 7 sites; all of these sites have intended land uses of 'More Vulnerable' and 'Less Vulnerable' flood risk categorisations.

Of these 7 sites, the following 6 sites have been identified to be outside of Flood Zone 3, taking account of PPS25 it is considered that these sites are appropriate for the intended usage.

Table I3

Site Name	Location	Area(Hectares)	FZ1	FZ2
South Prescot Action Area	South Prescot	47.4	Yes	
Development Opportunity Site (Kirby Staduim)	Valley Road, Kirkby	6.9	Yes	-
Development Opportunity Site (Prescot)	Sewell Street / Kemble Street, Prescot	0.6	Yes	-
Kirkby Town Centre Action Area	Kirkby Town Centre	19.2	Yes	
Ravenscourt Action Area	Ravenscourt, Halwood	2.9	Yes	
Tower Hill Action Area	Tower Hill, Kirby	80.8	-	Yes

Information received from Knowsley Council suggests the area of Kirkby Town Centre has a prevalence of surface water flooding issues from blocked gullies.

The remaining site is partially located within Flood Zone 3a and potentially Flood Zone 3b. The type of development for this area will determine the requirement for Exception Testing under PPS25. It cannot be discounted that the area is within Functional Floodplain, therefore, a more detailed assessment should be undertaken during a site specific FRA.

Table I4

Site Name	Location	Area(Hectares)	FZ3a	FZ3b	Potential FZ3b
North Huyton Action Area	North Huyton	185.5	Yes	-	Yes

I.1.3 Employment

Knowsley Council have identified 36 sites for employment development proposals. 32 of these sites have been identified in Flood Zone 1.

As the intended uses of these sites, are for business (Class B1), industrial (Class B2) and storage distribution (Class B8), their 'Less Vulnerable' classification means they are deemed appropriate for development within this flood risk zone.

Table I5

Ref	Location	Area (Hectares)	FZ1	FZ2
Sites in Knowsley Industrial Park				
E7	Depot Road	3.2	Yes	-
E8	Marl Road	0.5	Yes	-
E9	Arbour Lane	1.5	Yes	-
E13	Moss End Way (East)	2.1	Yes	-
E14	Moss End Way (West)	4.2	Yes	-
E15	North Perimeter Road / Moss End Way	5.3	Yes	-
E6	Perimeter Road /Acornfield Road	18.7	Yes	-
E31	Land adjacent to Knowsley rail freight terminal, Depot Road	1.1	Yes	-
E38	Land north of Kodak, Acornfield Road	3.4	Yes	-
E26	Land off Arbour Lane	1.2	Yes	-
E42	Land adjacent 2 Gladeswood Road, Kirkby Industrial Park	0.5	Yes	-
E29	Land at Webber Road	1.2	Yes	-
E35	Land adjacent Delphi Delco, Hornhouse Lane,	1.9	Yes	-
E28	Land at junction of Gores Road/Acornfield Road	0.8	Yes	-
E33	Land at corner of A580/Moorgate Lane	3.3	Yes	-
E40	Part of Yorkshire	1.7	Yes	-
E12	Britonwood	5.8	Yes	-
E10	Hornhouse Lane	3.0	Yes	-
E25	Part of Dairy Crest/Kraft site, A580	4.0	Yes	-

Ref	Location	Area (Hectares)	FZ1	FZ2
Sites in Knowsley Business Park				
E17	School Boys Plantation, Randles Road	0.5	Yes	-
E19	Gellings Lane / Randles Road	0.9	Yes	-
E20	Davis' Pits, Randles Road	0.8	Yes	-
E18	Ainsworth Lane / Penrhyn Road	2.9	Yes	-
E32	Land adjacent to Ethel Austin Site, Ainsworth	2.2	Yes	-
E27	Pehryhn/Villiers Road	2.2	Yes	-
E36	Land between Villiers Court and Overbrook Lane	0.5	Yes	-
E23	Land at junction of Penrhyn Road/School Lane	0.6	Yes	-
E24	Land Between Randles Road and School Lane	1.3	Yes	-
E37	Land to the east of Cross Huller, Randles Road/Gellings Road/ School Lane	0.9	Yes	-
E39	Land adjacent News International, Penrhyn Road	0.6	Yes	-
Regional Investment site	King Business Park, Prescot, M57/A57 junction	20.3	Yes	-

Ref	Location	Area (Hectares)	FZ1	FZ2
Sites In Halwood				
E1	Eastern Compound Land, Speke Boulevard, Halewood	18.5	Yes	-

The remaining 4 sites within this group, all within the Huyton Business Park area, are to some extent within Flood Zone 3a and are all potentially within Flood Zone 3b. These sites are identified in Table I6 below.

Table I6

Ref	Location	Area (Hectares)	FZ3a	FZ3b	Potential FZ3b
Sites in Huyton Business Park					
E4	Plot 5, Whiston Enterprise Park, Fallows Way	1.4	Yes	-	Yes
E30	Land at junction of Wilson Road/Stretton Way	0.8	Yes	-	Yes
E41	Land adjacent to BASF Coatings and Inks Ltd, Ellis Ashton Street	0.9	Yes	-	Yes
E2		8.1	Yes	-	Yes

The proposed usages (B1, B2 and B8) of the fours sites above (Table I6), are deemed appropriate if the sites are within Flood Zone 3a. If, however, any of the 4 sites are within Flood Zone 3b, taking account of PP25, it is considered that they are inappropriate for the intended use. Should any planning application come forward for development at the site there will be a requirement for a detailed site specific FRA to be submitted with the planning application, depending on the nature of the development and the intended end use.

I.1.4 Transport

Of the 8 Transport Development sites 7 are located within Flood Zone 1 'Low Probability' and therefore considered appropriate for development, the remaining site is located within Flood Zone 2 'Medium Probability' and is also considered appropriate for the proposed development.

Table I7

Ref	Location	FZ1	FZ2	FZ3a	FZ3b	Potential FZ3b
Proposed new station	Tower Hill	Yes	-	-	-	-
Proposed Park and Ride Site	Tower Hill	Yes	-	-	-	-
Proposed Park and Ride Site	Kirkby Park	Yes	-	-	-	-
Proposed Park and Ride Site	Huyton-with-Roby	Yes	-	-	-	-
Proposed Park and Ride Site	Prescot	Yes	-	-	-	-
Proposed Park and Ride Site	Whiston	Yes	-	-	-	-
Proposed Merseytram Route 2	Whiston - Huyton-	Yes	-	-	-	-
Proposed Merseytram Route 1	Gilmoss-Kirby	-	Yes	-	-	-

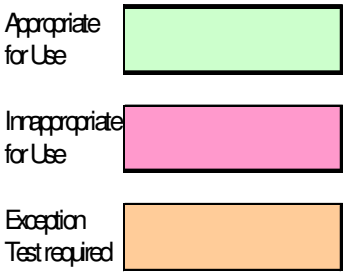
Summary of Site Specific Assessments

The site specific assessments undertaken within this section have identified whether the intended use of the site is appropriate for the level of flood risk to that site as detailed within PPS25. Taking account of PPS25, it is considered that these sites are appropriate. See Table I8 below

Consideration however must always be given to whether or not an alternative site is available with a lower flood risk regardless of the recommendations of PPS25. The Sequential Test dictates that all sites within Flood Zone 1 should be explored prior to sites within Flood Zone 2 and hence forth. The Flood Zones contained

within Appendix F provides the information that planners need to be able to undertake this Sequential process.

Table I8



Employment

Ref	Location	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
	Sites in Knowsley Industrial Park						
E7	Depot Road	FZ1					
E8	Marl Road	FZ1					
E9	Arbour Lane	FZ1					
E13	Moss End Way (East)	FZ1					
E14	Moss End Way (West)	FZ1					
E15	North Perimeter Road / Moss End Way	FZ1					
E6	Perimeter Road /Acornfield Road	FZ1					
E31	Land adjacent to Knowsley rail freight terminal, Depot Road	FZ1					
E38	Land north of Kodak, Acornfield Road	FZ1					
E26	Land off Arbour Lane	FZ1					
E42	Land adjacent 2 Gladeswood Road, Kirkby Industrial Park	FZ1					
E29	Land at Webber Road	FZ1					
E35	Land adjacent Delphi Delco, Hornhouse Lane, adjacent to junction with South Boundary Road	FZ1					
E28	Land at junction of Gores Road/Acornfield Road	FZ1					
E33	Land at corner of A580/Moorgate Lane	FZ1					
E40	Part of Yorkshire Imperial Metals off Coopers Lane.	FZ1					
E12	Britonwood	FZ1					
E10	Hornhouse Lane	FZ1					
E25	Part of Dairy Crest/Kraft	FZ1					

Ref	Location	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
	Sites in Knowsley Business Park						
Regional Investment site	King Business Park, Prescot, M57/A57 junction	FZ1					
E32	Land adjacent to Ethel Austin Site, Ainsworth Lane	FZ1					
E27	Pehryhn/Villiers Road	FZ1					
E17	School Boys Plantation, Randles Road	FZ1					
E19	Gellings Lane / Randles Road	FZ1					
E20	Davis' Pits, Randles Road	FZ1					
E18	Ainsworth Lane / Penrhyn Road	FZ1					
E36	Land between Villiers Court and Overbrook	FZ1					
E23	Land at junction of Penrhyn Road/School	FZ1					
E24	Land Between Randles Road and School Lane	FZ1					
E37	Land to the east of Cross Huller, Randles	FZ1					
E39	Land adjacent News International, Penrhyn	FZ1					

Ref	Location	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
	Sites In Halwood						
E1	Eastern Compound Land, Speke Boulevard,	FZ1					

Ref	Location	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
	Sites in Huyton Business Park						
E2		FZ3a					
E4	Plot 5, Whiston Enterprise Park, Fallows Way	FZ3a					
E30	Land at junction of Wilson Road/Stretton Way	FZ3a					
E41	Land adjacent to BASF Coatings and Inks Ltd, Ellis Ashton Street	FZ3a					

Housing Development

Ref	Location	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
H1	Former Bridgefield Forum site, Cartbridge Lane, Halewood	FZ3a					
H2	Former flats at 62-100 Kipling Avenue, Huyton	FZ1					
H3	Former Wingate Towers site, Alamein Road, Huyton	FZ1					
H4	Land at Thingwall Lane, Huyton	FZ1					
H5	Land adjacent to St Andrew's Church Hall, Boundary Drive, Halewood	FZ1					
H6	Quarryside Drive, Kirkby	FZ1					
H7	Land at Delph Lane/Two Butt Lane, Whiston	FZ1					
H8	Trecastle Road, Kirkby	FZ1					

Action Areas

Ref	Allocated Site	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
North Huyton Action Area	North Huyton	FZ3a					
Kirkby Town Centre Action Area	Kirkby Town Centre	FZ1					
Ravenscourt Action Area	Ravenscourt, Halwood	FZ1					
Tower Hill Action Area	Tower Hill, Kirby	FZ2					
South Prescot Action Area	South Prescot	FZ1					
Development Opportunity Site (Kirby Staduim)	Valley Road, Kirkby	FZ1					
Development Opportunity Site (Prescot)	Sewell Street / Kemble Street, Prescot	FZ1					

Transport

Ref	Flood Zone	Essential infrastructure	Water	Highly	More	Less
Tower Hill	FZ1					
Tower Hill	FZ1					
Kirkby Park	FZ1					
Huyton-with-Roby	FZ1					
Prescot	FZ1					
Whiston	FZ1					
Mersey Route 2 - Whiston - Huyton-with-Roby	FZ1					
Mersey Route 1 - Gilmoss-Kirby	FZ2					

I.2 Impacts of Climate Change on Sequential Testing Results – Knowsley Council

As a result of climate change, the frequency in higher magnitude events is likely to increase, resulting in increase flood risk throughout the Knowsley area.

Lack of climate change flood risk information for Knowsley Council has resulted in adoption of Flood Zone 2, (where the annual probability of flooding is 0.1%) flood risk information. In the absence of detailed flood risk information, this indicative flood envelope is considered to best represent Flood Zone 3a under a climatic change scenario.

The impacts of a climate change scenario are that proposed development sites previously located within Flood 2 would now be located in Flood Zone 3a.

This scenario would affect the transport development site of the proposed Mersey Tram Route 1. This Essential Infrastructure would, under the redefinition of the Flood Zone, fall within Flood Zone 3a.

Continual review of the SFRA should be undertaken as more available information of the effects of climate change on flood risk become available for the Knowsley area.

I.3 Site Specific Results – Sefton Borough

Sefton Borough Council has identified which sites have been allocated for housing and economic usage. The Sequential Test has been applied to each of these sites and their associated land uses and resulted in the following 3 groupings:

1. Sites where proposed land use is appropriate
2. Sites which require application of the Exception Test
3. Sites where the intended land use is not appropriate

It should be noted that the Flood Zone attributed to the allocation site represents the 'worst case' as prescribed by PPS25. No consideration is given to the proportions of the site within each floodplain which, at a site specific level of detail, may actually provide the required area for development outside of the 'worst case' Flood Zone. At the end of this document there is a table of the proportions of each site that are within each Flood Zone classification, this information supports the following site specific comments.

Information on surface water flooding locations was provided by Sefton Council. This indicated several areas which had experienced surface water flooding in the past. None of these locations were adjacent to, or in, proposed development areas, and therefore surface water flooding is not discussed further in this section.

I.3.1 Housing Allocations

Residential dwellings are categorised to have a Flood Risk Vulnerability Index of 'More Vulnerable' and therefore, according to Table D.3 of PPS25, they are considered appropriate for development in either Flood Zone 1 or Flood Zone 2, require an Exception Test if proposed within Flood Zone 3a and are inappropriate for Flood Zone 3b.

Of the 10 housing allocations, the following 9 sites are considered appropriate for housing development:

Table I9

UC_Ref	Address	Flood Zone
H 3.1	Monfa Road, Orrell	FZ1
H 3.2	Brookhill Road, Orrell	FZ1
H 3.3	Ash Road, Orrell	FZ1
H 3.4	Hawthorne Road, Orrell	FZ1
H 3.5	Hawthorne Road, Orrell	FZ1
H 3.6	Hawthorne Road, Orrell	FZ1
H 3.7	Hawthorne Road, Orrell	FZ1
H 3.9	Hawthorne Road, Orrell	FZ1
H 3.8	Aughton Road, Orrell	FZ1

The following site is identified as falling in Flood Zone 3a, and therefore it requires an Exception Test, however only 0.2% of the proposed area falls in Flood Zone 3a, so it may be possible to plan the site where housing development takes place in 99.8% of the total area and in Flood Zone 1 and 2, leaving the 0.2% of area in Flood Zone 3a to more appropriate water compatible usage such as public open space. These investigations should be undertaken during a site specific FRA.

Table I10

UC_Ref	Address	Flood Zone
H 4	Town Lane, Blowick Moss	FZ3a

Only the site at Pine Grove is less than 1 hectare in size and therefore does not require a site specific FRA as it is in Flood Zone 1. All other potential housing sites listed are greater than 1 hectare in area, therefore they all require site specific FRAs regardless of the Flood Zone in which they reside.

I.3.2 Transport Sites

Sefton Council have identified 14 transport sites. As transport sites, these fall under the "Essential Infrastructure" category, and in accordance with PPS25, the sites are considered appropriate for Flood Risk Zone 1 and 2, or require an Exception Test for any development falling in Flood Zone 3a and 3b.

Of the 14 Transport sites in Sefton, the following 13 sites are all identified to be outside of Flood Zone 3 and therefore, in accordance with PPS25, they are considered appropriate for the intended usage.

Table I11

UC_Ref	Address	Flood Zone
	Derby Road dualling	FZ 1
	North Mersey Railway	FZ 1
T4	Birkdale Station - Park & Ride Extension	FZ 1
T4	Formby Station - Park & Ride Extension	FZ 1
T4	Formby Station - Park & Ride Extension	FZ 1
T4	Maghull Station - Park & Ride Extension	FZ 1
T4	Aintree Station - Park & Ride Extension	FZ 1
T4	Aintree Station - Park & Ride Extension	FZ 1
	Southport Station	FZ 1
T3	Chapel Street	FZ 1
	Chapel Street	FZ 1
	Hall Road Station - Park & Ride Site	FZ 1
R 3	Southport Station Complex	FZ 1

There is only 1 site out of this group that is identified to be partially within Flood Zone 3a and is identified below.

Table I12

UC_Ref	Address	Flood Zone
	Southeastern Park & Ride	FZ 3a

This site is identified to be within Flood Zone 3a and therefore, in accordance with PPS25, the site would require an Exception Test to be undertaken as part of a site specific FRA, however, this site has already been developed.

All sites which are within Flood Zone 2, 3a or 3b and sites over 1 hectare in size require a site specific FRA, these include:

- North Mersey Railway
- Southeastern Park and Ride
- Any proposed station with a planned area of larger than 1 hectare

I.3.3 Industrial Sites

The Industrial Sites contain 16 sites in total. The industrial land use is considered to be 'Less Vulnerable' and therefore, in accordance with PPS25, the intended use is considered appropriate for Flood Risk Zones 1, 2 and 3a.

Of these 16 sites, the following 15 sites have been identified to be outside of Flood Zone 3b and are therefore considered appropriate.

Table I13

UC_Ref	ADDRESS	Flood Zone
EDT 6.16	Blowick Bus Depot	FZ 1
EDT 6.18	Blowick	FZ 1
EDT 6.1	Brasenose Road	FZ 1
EDT 6.6	Canal Street	FZ 1
EDT 6.2	Pacific Road	FZ 1
EDT 6.7	Netherton Industrial Estate	FZ 1
EDT 6.5	Netherton Industrial Estate	FZ 1
EDT 6.3	Netherton Industrial Estate	FZ 1
EDT 6.4	Netherton Industrial Estate	FZ 1
EDT 6.9	Aintree Business Park	FZ 1
EDT 6.8	Aintree Business Park	FZ 1
EDT 6.11	Netherton Industrial Estate	FZ 1
EDT 6.10	Hawthorne Road, Bootle	FZ 1
EDT 6.14	Crossens Way	FZ 3a
EDT 6.12	Sefton Lane Industrial Estate	FZ 3a

The remaining site is located within Flood Zone 3b.

Table I14

UC_Ref	ADDRESS	Flood Zone
EDT 6.13	Formby Business Park	FZ 3b

As this site is located within Flood Zone 3b, in accordance with PPS 25, the site is inappropriate for the intended use. The majority of the business park is contained within Flood 3b, and therefore despite being a low risk category it is not possible to plan the site so it does not fall into this Flood Zone. The development of this site should not proceed until all other suitable sites of lower risk have been developed and the Exception Test is passed.

Although due to flood risk the only site requiring a site specific FRA is the Formby Business park site, site specific FRAs are also required for the following sites as they are greater than 1 hectare in area:

- Blowick Bus Depot
- Three of the Netherton Industrial Estate sites
- Both Aintree Business Park sites
- Hawthorne Road
- Crossens Way

I.3.4 Employment Sites

Sefton Borough Council have identified 5 potential employment sites. It is assumed these sites fall into the 'Less Vulnerable' category, and as such PPS25 considers them appropriate for Flood Risk Zones 1, 2 and 3a.

All these 5 sites fall in Flood Zone 1 and therefore, taking account of PPS25, the sites are considered appropriate for the intended usage.

Table I15

UC_Ref	Address	Floo
EDT 3.1	Peerless Refinery	FZ1
EDT 3.3	Senate Business Park	FZ1
EDT 3.2	Atlantic Park	FZ1
EDT 4	Southport Commerce Park	FZ1
EDT 4	Southport Commerce Park	FZ1

All 5 sites are, however, larger than 1 hectare, and therefore require a site specific FRA.

I.3.5 Retail Sites

Sefton Borough Council have identified 2 potential employment sites. These sites fall into the 'Less Vulnerable' category, and as such PPS25 considers them appropriate for Flood Risk Zones 1, 2 and 3a.

Both sites fall in Flood Zone 1 and therefore, taking account of PPS25, the sites are considered appropriate for the intended usage.

Table I16

UC_Ref	ADDRESS	Flood Zone
R5	Strand Road	FZ 1
R10	A5036/A5090	FZ 1

Both sites are larger than 1 hectare, and therefore require a site specific FRA.

I.3.6 Development Brief Sites

Sefton Borough Council have identified 30 individual sites under the description of development brief sites, although there is some overlap with previously defined areas. As proposed land uses are unknown, it is conservatively assumed that these sites fall into the 'More Vulnerable' category. Therefore, according to Table D.3 of PPS25, they are considered appropriate for development in either Flood Zone 1 or Flood Zone 2, require an Exception Test if proposed within Flood Zone 3a and are inappropriate for Flood Zone 3b.

The Aughton Road site corresponds to the Aughton Road housing site, while the Hawthorne Road site includes Hawthorne Road industrial site and Mona Road area and includes 6 previously identified housing areas along with an additional area.

All 30 sites fall in Flood Zone 1 and therefore, taking account of PPS25, these sites are considered appropriate for the intended use.

Table I17

UC_Ref	ADDRESS	Flood Zone
	Wadham Road	FZ 1
	Wadham Road	FZ 1
	Bedford Road	FZ 1
	Bedford Road	FZ 1
	Hertford Road/Keble Road	FZ 1
	Exeter Road/Hertford Road	FZ 1
	Kings Road/Exeter Road	FZ 1
	Queens Road/Exeter Road	FZ 1
	Queens Road	FZ 1
	Queens Road	FZ 1
	Keble Road	FZ 1
	Queens Road	FZ 1
	Queens Road	FZ 1
	Queens Road	FZ 1
	Bianca Street	FZ 1
	A567	FZ 1
	A567	FZ 1
	A568	FZ 1
	A569	FZ 1
	A570	FZ 1
	Hertford Road/Keble Road	FZ 1
	Exeter Road/Hertford Road	FZ 1
	A567/Wadham Road	FZ 1
	Bedford Road	FZ 1
	Monea Road/Springwell Road	FZ 1
	Thornton Avenue/Hermitage Grove	FZ 1
EDT 7.2	Hawthorne Road	FZ 1
	Hawthorne Road/Monea Road	FZ 1
	Aughton Road	FZ 1
EDT 17.3, H 6.5	Hawthorne Road	FZ 1

Site specific FRAs are required for the following sites as they are greater than 1 hectare in area:

- Wadham Road
- Springwell Road
- Monea Road
- Two sites on Hawthorne Road

Should the Queens Bedford development brief be considered as a single site, it will be larger than one hectare and require a site specific flood risk assessment. However if each polygon is considered separately, this will not be required. Similarly the Thornton Avenue and Aughton Road polygons in the Klondyke development brief do not on their own exceed 1 hectare in size, and therefore do not require a site specific FRA. However if the Klondyke development brief is assessed as a whole, these sites will need to be included.

I.3.7 Other Sites

Sefton Borough Council have identified 7 other sites. Altcar Rifle Range and RAF Woodvale are currently MOD sites and therefore classified as “Water compatible development” and suitable for all Flood Zones.

Southport Hospital and Ashworth Hospital are “More Vulnerable” land uses, Seaforth Village and Coffee House Bridge land use is not known, and therefore it is conservatively assumed they might fall in the “More Vulnerable” land use category. Therefore, according to Table D.3 of PPS25, they are considered appropriate for development in either Flood Zone 1 or Flood Zone 2, require an Exception Test if proposed within Flood Zone 3a and are inappropriate for Flood Zone 3b.

The Ashworth Hospital site falls outside of Flood Zone 1 or 2, this site falls within Flood Zone 3a and therefore requires an Exception Test. 2.7% of the site falls in Flood Zone 3a, with just 0.7% of the site falling in Flood Zone 2 and the remainder of the site falling in Flood Zone 1.

The Power House site falls within Flood Zone 3b, although only 0.5% of the site falls within this Zone. It may, therefore, be possible to plan the site so that all development is either inside Flood Zone 1 or 2 and appropriate for the intended land use, or, after passing an Exception Test, planned for the area within Flood Zone 3a – but only after all Flood Zone 1 and 2 land allocated.

Table I18

UC_Ref	ADDRESS	Flood Zone
H 5	Southport Hospital mixed use	FZ 1
	Seaforth Village area action plan	FZ 1
	Coffee House Bridge SPD	FZ 1
GBC 5	RAF Woodvale	FZ 1
GBC 5	Altcar Rifle Range	FZ 2
GBC 4	Ashworth Hospital	FZ 3a
GBC 3	Power House Site	FZ 3b

All 7 sites are larger than 1 hectare, and therefore require a site specific FRA.

Summary of Site Specific Assessments

The site specific assessments undertaken within this section have identified whether the intended use of the site is appropriate for the level of flood risk to that site as detailed within PPS25. The majority of these sites are considered appropriate as set out by PPS25.

Table I19

Appropriate for Use

Innappropriate for Use

Exception Test required

Potential housing Sites

UC_Ref	Allocated Site	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
H 4	Town Lane, Blowick Moss	FZ3a					
H 3.1	Monfa Road, Orrell	FZ1					
H 3.2	Brookhill Road, Orrell	FZ1					
H 3.3	Ash Road, Orrell	FZ1					
H 3.4	Hawthorne Road, Orrell	FZ1					
H 3.5	Hawthorne Road, Orrell	FZ1					
H 3.6	Hawthorne Road, Orrell	FZ1					
H 3.7	Hawthorne Road, Orrell	FZ1					
H 3.9	Hawthorne Road, Orrell	FZ1					
H 3.8	Aughton Road, Orrell	FZ1					

Industrial Sites

UC_Ref	Address	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
EDT 6.14	Crossens Way	FZ3a					
EDT 6.16	Blowick Bus Depot	FZ1					
EDT 6.18	Blowick	FZ1					
EDT 6.1	Brasenose Road	FZ1					
EDT 6.6	Canal Street	FZ1					
EDT 6.2	Pacific Road	FZ1					
EDT 6.7	Netherton Industrial Estate	FZ1					
EDT 6.5	Netherton Industrial Estate	FZ1					
EDT 6.3	Netherton Industrial Estate	FZ1					
EDT 6.4	Netherton Industrial Estate	FZ1					
EDT 6.9	Aintree Business Park	FZ1					
EDT 6.8	Aintree Business Park	FZ1					
EDT 6.12	Sefton Lane Industrial Estate	FZ3a					
EDT 6.13	Formby Business Park	FZ3b					
EDT 6.11	Netherton Industrial Estate	FZ1					
EDT 6.10	Hawthorne Road, Bootle	FZ1					

Transport Sites

UC_Ref	Address	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
	Derby Road dualling	FZ1					
	North Mersey Railway	FZ1					
T4	Birkdale Station - Park & Ride Extension	FZ1					
T4	Formby Station - Park & Ride Extension	FZ1					
T4	Formby Station - Park & Ride Extension	FZ1					
T4	Maghull Station - Park & Ride Extension	FZ1					
T4	Aintree Station - Park & Ride Extension	FZ1					
T4	Aintree Station - Park & Ride Extension	FZ1					
	Southport Station	FZ1					
	Southeastern Park & Ride	FZ3a					
T3	Chapel Street	FZ1					
	Chapel Street	FZ1					
	Hall Road Station - Park & Ride Site	FZ1					
R 3	Southport Station Complex	FZ1					

Employment Sites

UC_Ref	Allocated Site	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
EDT 3.1	Peerless Refinery	FZ1					
EDT 3.3	Senate Business Park	FZ1					
EDT 3.2	Atlantic Park	FZ1					
EDT 4	Southport Commerce Park	FZ1					
EDT 4	Southport Commerce Park	FZ1					

Retail Sites

UC_Ref	Allocated Site	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
R5	Strand Road	FZ1					
R10	A5036/A5090	FZ1					

Development Briefs

UC_Ref	Allocated Site	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
	Wadham Road	FZ1					
	Wadham Road	FZ1					
	Bedford Road	FZ1					
	Bedford Road	FZ1					
	Hertford Road/Keble Road	FZ1					
	Exeter Road/Hertford Road	FZ1					
	Kings Road/Exeter Road	FZ1					
	Queens Road/Exeter Road	FZ1					
	Queens Road	FZ1					
	Queens Road	FZ1					
	Keble Road	FZ1					
	Queens Road	FZ1					
	Queens Road	FZ1					
	Queens Road	FZ1					
	Bianca Street	FZ1					
	A567	FZ1					
	A567	FZ1					
	A568	FZ1					
	A569	FZ1					
	A570	FZ1					
	Hertford Road/Keble Road	FZ1					
	Exeter Road/Hertford Road	FZ1					
	A567/Wadham Road	FZ1					
	Bedford Road	FZ1					
	Monea Road/Springwell Road	FZ1					
	Thornton Avenue/Hermitage Grove	FZ1					
EDT 7.2	Hawthorne Road	FZ1					
	Hawthorne Road/Monea Road	FZ1					
	Aughton Road	FZ1					
EDT 17.3,	Hawthorne Road	FZ1					

Other Sites

	Allocated Site	Flood Zone	Essential infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
H 5	Southport Hospital mixed use	FZ1					
	Seaforth Village area action plan	FZ1					
	Coffee House Bridge SPD	FZ1					
GBC 5	RAF Woodvale	FZ1					
GBC 5	Altcar Rifle Range	FZ2					
GBC 4	Ashworth Hospital	FZ3a					
GBC 3	Power House Site	FZ3b					

Consideration however must always be given to whether or not an alternative site is available with a lower flood risk regardless of the recommendations of PPS25. The Sequential Test dictates that all sites within Flood Zone 1 should be explored prior to sites within Flood Zone 2 and hence forth.

The Flood Zones contained within Appendix F provides the information that planners need to be able to undertake this Sequential process.

I.4 Impacts of climate change on the Sequential Test Results – Sefton Borough

As a result of climate change, the frequency in higher magnitude events is likely to increase, resulting in increase flood risk throughout the Sefton area.

Lack of climate change flood risk information for Sefton has resulted in adoption of Flood Zone 2, (where the annual probability of flooding is 0.1%) flood risk information. In the absence of detailed flood risk information, this indicative flood envelope is considered to best represent Flood Zone 3a under a climatic change scenario. Flood Zone 3a with Climate Change is shown in Appendix G.

The impacts of this are that there is only one site in Sefton (Altcar Rifle Range) which was previously within Flood Zone 2 that would now be located within Flood Zone 3a. Given this is a MOD site and therefore classed as Water Compatible, the impact of the potential Zone change would not affect the sites appropriateness.

Continual review of the SFRA should be undertaken as more available information of the effects of climate change on flood risk become available for the Sefton area.

I.5 Breakdown of Areas in Multiple Flood Zones

It has been described earlier that the Flood Zone attributed to the allocation site represents the 'worst case' as prescribed by PPS25. No consideration is given to the proportions of the site within each floodplain which, at a site specific level of detail, may actually provide the required area for development outside of the 'worst case' Flood Zone. Below are area breakdowns, by percentage, for all sites that are located in more than just Flood Zone 1. This has supplied the data to earlier sections in this report.

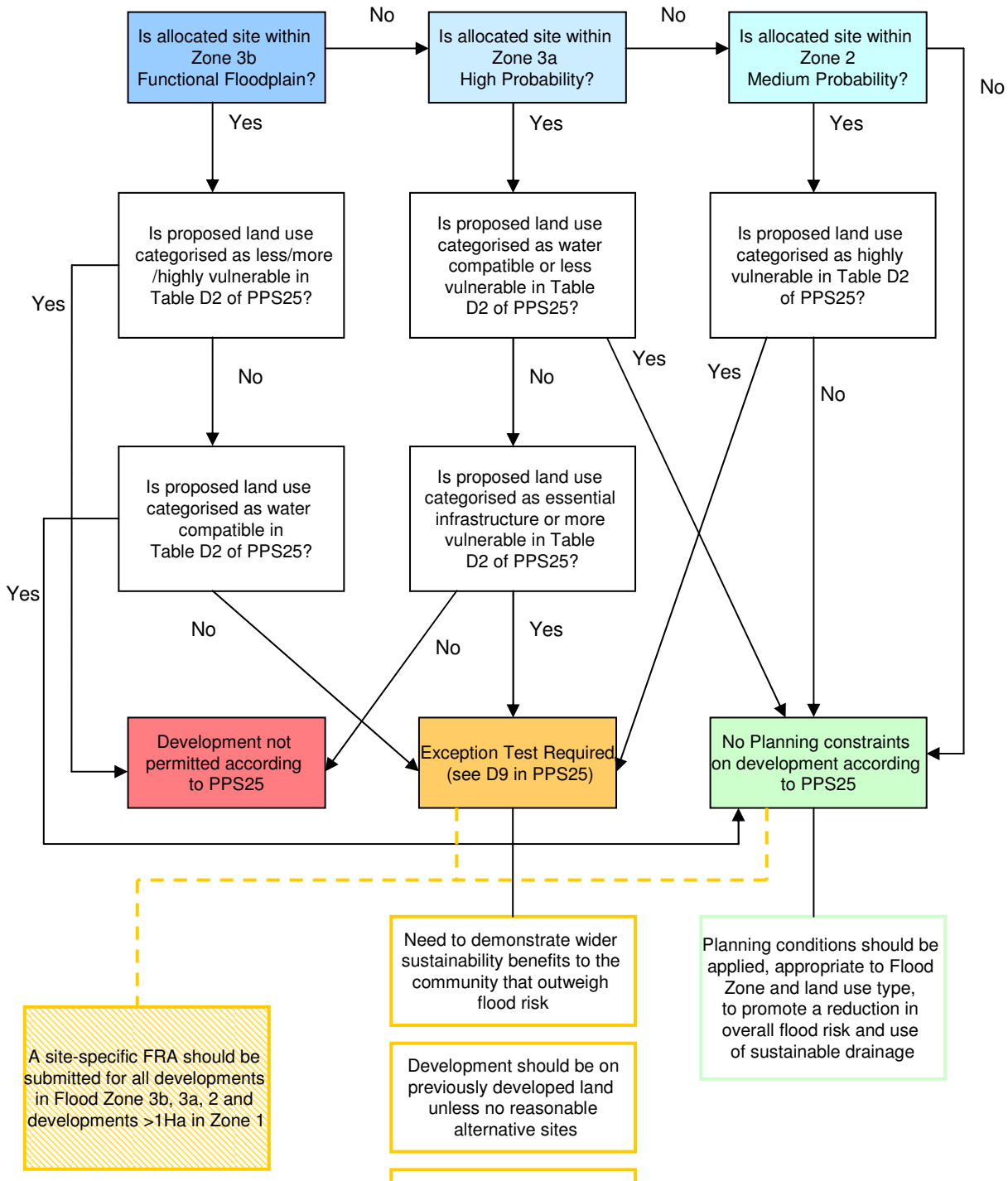
Table I20

		Percentage Breakdown			
Knowsley Sites	Area (Ha)	FZ1	FZ2	FZ3a	FZ3b
H1	8.3	27.2	23.4	49.4	0.0
Tower Hill Action Area	80.8	99.3	0.7	0.0	0.0
North Huyton Action Area	185.5	88.6	10.7	0.8	0.0
E4	1.4	79.0	6.5	14.8	0.0
E30	0.8	68.5	20.8	10.8	0.0
E41	0.9	0.3	13.3	86.3	0.0
E2	8.1	85.2	4.9	9.9	0.0
Proposed Merseytram Route 1	4112.0	91.8	8.2	0.0	0.0

Table I21

		Percentage Breakdown			
Sefton Sites	Area (Ha)	FZ1	FZ2	FZ3a	FZ3b
H4	23.5	95.8	4.0	0.2	0.0
Southeastern Park & Ride	4.4	31.4	57.9	10.7	0.0
EDT 6.14	1.7	0.0	2.2	97.8	0.0
EDT 6.12	2.0	69.8	3.9	26.4	0.0
EDT 6.13	0.4	0.0	0.0	0.0	100.0
GBC 5	3.8	79.1	20.9	0.0	0.0
GBC 4	41.9	96.5	0.7	2.7	0.0
GBC 3	5.1	7.6	88.5	3.0	1.0

Planners from Knowsley Council and Sefton Council should carry out the Sequential Test (refer Section 6 of the SFRA) before considering the development of an allocated site



A site-specific FRA should be submitted for all developments in Flood Zone 3b, 3a, 2 and developments >1Ha in Zone 1

Need to demonstrate wider sustainability benefits to the community that outweigh flood risk

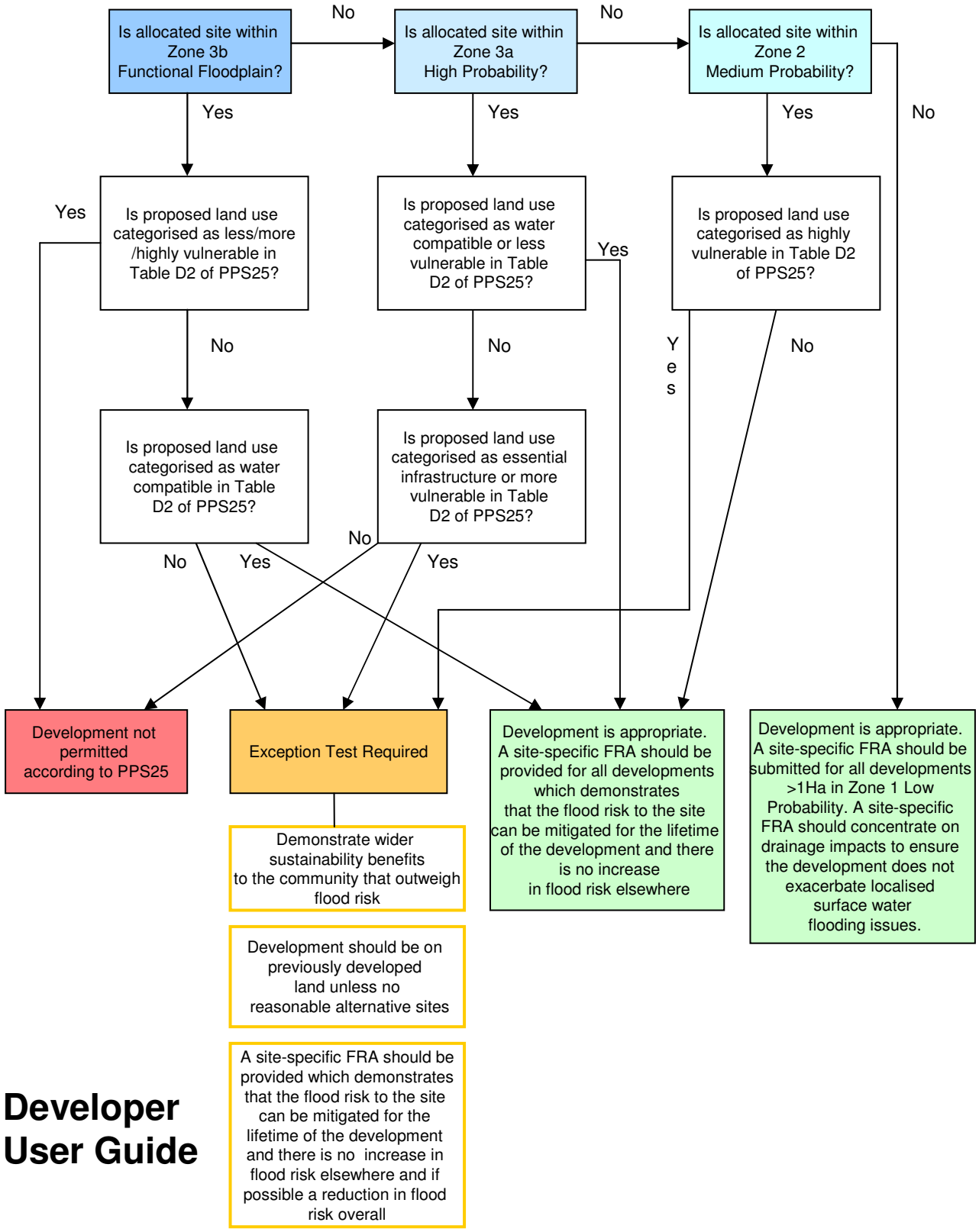
Development should be on previously developed land unless no reasonable alternative sites

Planning conditions should be applied to ensure development will be safe without increasing flood risk elsewhere and where possible will reduce flood risk overall

Planning conditions should be applied, appropriate to Flood Zone and land use type, to promote a reduction in overall flood risk and use of sustainable drainage

Knowsley Council and Sefton Council Planning User Guide

Unless development is proposed on an allocated site that has been included in
The SFRA then the Developer should carry out the Sequential Test (refer Section 6 of the SFRA) before considering the development of an allocated site



Developer User Guide

Guidance Notes for Developers

How to Use the Strategic Flood Risk Assessment

The Strategic Flood Risk Assessment is the assessment and categorisation of flood risk on a district wide basis in accordance with Planning Policy Statement 25 (PPS25)[1]. SFRAs refine information on the probability of flooding, taking other sources of flooding and the impacts of climate change into account. The SFRA provides the basis for applying the Sequential Test and the Exception Test where consideration needs to be given to the impact of the flood risk management infrastructure on the frequency, impact, speed of onset, depth and velocity of flooding within the Flood Zones considering a range of flood risk management maintenance scenarios.

A developer should consider flood risk issues at a site as early as possible. The SFRA can be used to provide an indication of the likely flood risk issues at a site from all sources of flooding. Developers should identify whether the development site has been allocated for that type of land use in the Local Development Documents. For allocated sites the SFRA can provide information on the application of the Sequential Test and where undertaken the Exception Test to see if the land use is appropriate.

When is a Flood Risk Assessment Required?

A Flood Risk Assessment (FRA) will be required to accompany planning applications for:

- any development proposals of 1 hectare or greater in Flood Zone 1
- any development proposals in Medium Probability Flood Zone 2
- any development proposals in High Probability Flood Zone 3

The FRA should identify and assess the risks of all sources of flooding to and from the development, taking into account climate change and demonstrate how the risk will be managed. Appendix B1 of the SFRA provides details on the flood zones for Knowsley and Sefton and Appendix B2 provides an indication of the likely flood extents taking into consideration the influence of climate change. Appendix D is a combined flood risk maps and provides an indication of risk from surface water and ground water flooding in addition to fluvial and tidal flooding.

A FRA will also be required where the proposed development or change of use to a more vulnerable class may be subject to other sources of flooding or where the Environment Agency, Internal Drainage Board and/or other bodies have indicated that there may be drainage problems.

Standard Flood Risk Management Guidance for Developers

The broad aim of the Planning Policy Statement 25 is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages of any development.

Responsibility for this assessment lies with developers and they must demonstrate the following:

- Whether the proposed development is likely to be affected by current or future flooding from any source (see Appendices B1, B2 and D).
- Whether the proposed development will increase flood risk elsewhere.
- Whether the measures proposed to deal with any flood risk are sustainable.

[1] Planning Policy Statement 25: Development and Flood Risk. Department for Communities and Local Government (December 2006)

The developer must prove to the Local Planning Authority and the Environment Agency that the existing flood risk or flood risk associated with the proposed development can be satisfactorily managed.

The detail to be provided by a FRA will depend on where the proposed site fits within the development framework, particularly on its justification against the sequential test, described in the SFRA.

Development should follow the standard flood risk assessment approach provided by the Environment Agency and Ciria, as follows:

- National Standing Advice to Local Planning Authorities for Planning Applications - Development and Flood Risk in England' (June 2004)
- CIRIA Report C624 "Development and Flood Risk – Guidance for the Construction Industry" (2004).

The general requirements of a FRA are listed in Appendix E of PPS25 and within the Practice Guide to PPS25. Further guidance on the level of detail required for a FRA can be found in the Environment Agency's Flood Risk Assessment guidance notes available at http://www.environment-agency.gov.uk/research/planning/33098.aspx.

Guidance for Development within Each Flood Zone

An FRA should be commensurate with the risk of flooding to the proposed development. For example, where the risk of flooding of the site is negligible (Zone 1 Low Probability) there is little benefit to be gained in assessing the potential risk to life and/or property as a result of flooding. The particular requirements for FRAs within each of the flood zones delineated within PPS25 are outlined below.

Flood Zone 1 Low Probability

There are generally no flood risk related constraints placed upon future development within Zone 1 Low Probability according to PPS25; however it is important to recognise that if development is not carefully managed within this zone it may adversely affect the existing flooding regime.

The risks of alternative sources of flooding (e.g. groundwater, pluvial) need to be considered Appendix D provides an indication of the risk of flooding from other sources whilst Section 3.4 and 3.5 of the SFRA Report outlines the flood risk sources for Knowsley and Sefton respectively. The proposed development should also consider surface water runoff to ensure that there are no detrimental effects to existing development and where possible the runoff is reduced through sustainable drainage systems.

Flood Zone 2 Medium Probability

To satisfy the requirements of the Sequential Test, PPS25 recommends that development within Flood Zone 2 should be restricted to 'essential infrastructure', 'water compatible', 'more vulnerable' or 'less vulnerable' land uses.

Where non-flood risk related planning matters dictate that highly vulnerable development should be considered further within Flood Zone 2 it will be necessary to carry out the Exception Test.

PPS states that for the Exception Test to be passed:

1. *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.*
2. *the development should be on developable, previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and*

3. *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

The risks of alternative sources of flooding (e.g. groundwater, pluvial) need to be considered and Appendix D provides an indication of the risk of flooding from other sources. The proposed development should consider surface water runoff to ensure that there are no detrimental effects to existing development and where possible the runoff is reduced through sustainable drainage systems.

As part of the FRA, it will be necessary to demonstrate that the residual risk of flooding can be effectively managed and a planned evacuation route or safe haven can be provided.

Flood Zone 3a High Probability

To satisfy the requirements of the Sequential Test, PPS25 recommends that development within Flood Zone 3a should be restricted to 'Less Vulnerable' and 'Water Compatible' land uses.

Where non-flood risk related planning matters dictate that 'more vulnerable' vulnerable development and 'Essential Infrastructure' should be considered further within Flood Zone 3a it will be necessary to carry out the Exception Test (see above for details).

An FRA should include the following:

- The vulnerability of the development to fluvial and/or tidal flooding as well as other sources.
- The impact of climate change over the lifetime of the development on the flooding regime, i.e. maximum water levels, flood extents and flow paths.
- The effect of the new development on surface water runoff ensuring that there are no detrimental effects to existing development and where possible that runoff is reduced through sustainable drainage systems.
- Demonstration that residual risks of flooding, after existing and proposed flood management and mitigation measures are taken into account, are acceptable.
- Demonstration that dry access can be provided to enable the safe evacuation in the case of flooding or where this is not achievable a safe haven can be provided.

Flood Zone 3b Functional Floodplain

To satisfy the requirements of the Sequential Test, PPS25 recommends that development within Flood Zone 3b should be restricted to 'water compatible' land uses.

Where non-flood risk related planning matters dictate that 'Essential Infrastructure' should be considered further within Flood Zone 3b it will be necessary to carry out the Exception Test (see above for details).

An FRA should include the following:

- The vulnerability of the development to fluvial and/or tidal flooding as well as other sources.
- The impact of climate change over the lifetime of the development on the flooding regime, i.e. maximum water levels, flood extents and flow paths.
- The effect of the new development on surface water runoff ensuring that there are no detrimental effects to existing development and where possible that runoff is reduced through sustainable drainage systems.
- Demonstration that residual risks of flooding, after existing and proposed flood management and mitigation measures are taken into account, are acceptable.
- Demonstration that dry access can be provided to enable the safe evacuation in the case of flooding or where this is not achievable a safe haven can be provided.

Additional Guidance

Undefended Floodplain

Areas at risk of fluvial flooding need to be assessed against the 1% annual exceedance probability (AEP) or 1 in 100 year event criteria with 0.5% AEP or 1 in 200 year event criteria for tidal flooding. The Environment Agency's hydraulic models may be made available for use by developers to determine the site's vulnerability to flooding. The developer will need to firstly ensure that the models are fit for purpose and sufficiently detailed to provide an accurate understanding of flood risk to the site. If existing models are not available, then a developer will need to assess the extent and requirements of any modelling work that is required. Detailed hydraulic modelling will involve the following:

- Carrying out a hydrological assessment using Flood Estimation Handbook techniques and using gauging records where available.
- Constructing an in-bank model using up to date survey data including structures, e.g. bridges, weirs, culverts and sluices.
- Extending the in-bank model to include floodplains where necessary using appropriate hydraulic modelling approaches to replicate the extent, storage and conveyance of the floodplains, e.g. through extended cross sections, reservoir units or 2-D modelling.
- Calibrating or verifying the hydraulic model where hydrometric monitoring data or flood records are available.
- Carrying out sensitivity analysis to confirm modelling assumptions and assess climate change impacts.
- Mapping of flooding extents

Defended Floodplain

Development sites within a defended tidal or fluvial floodplain are at particular risk due to the risk of the defences being overtopped or breached, resulting in the rapid onset of fast flowing and deep water flooding with little or no warning.

Residual risk from the breach or overtopping of defences needs to be considered as part of a FRA. Defra's[2] Flood Risk Assessment Guidance for New Development provides guidance on the level of risk related to distance and flood depth for overtopping and breaching scenarios.

The objectives of a breach analysis are as follows:
- to determine the Rapid Inundation Zone where there is a potential risk to life
- to investigate the impact of the proposed development on the flood risk to others
- to test the effectiveness of mitigation measures

Consideration of flood risk behind defences should take into consideration the standard of protection and design freeboard of the flood defence along with its condition and potential mechanisms of failure. The parameters of a breach in terms of potential location, width and invert level as well as the duration of a flood event should be agreed with the Environment Agency prior to any analysis.

In Sefton, areas benefiting from defences are shown to the north of Southport and the south of Formby and are shown in Appendix A3. Consideration should be given to the breach and overtopping of the defences and coastal dunes whilst considering the influence of the Alt and Crossens pumping stations.

[2] Flood Risk Assessment Guidance for New Development Phase 2: Framework and guidance for Assessing and Managing Flood Risk for New Development – Full Documentation and Tools. R&D Technical Report FD2320/TR2. Defra/Environment Agency 2005

There are no areas within Knowsley that benefit from formal EA flood defence assets although there are raised linear embankments which provide less than a 1% AEP (1 in 100 year event) flood defence provision.

Therefore, for Sefton and Knowsley, where the existing defences have a standard of protection less than 1% Annual Exceedance Probability (AEP) (1 in 100 year event) they may be overtopped and even submerged during a 1% AEP (1 in 100 year event) flood event and out of bank flow will occur in a manner almost as if no defences existed.

Design Floor Levels

It may be feasible to reduce the risk to a development through raising the ground level above the level of flood risk.

Floor levels should be raised above the 1% AEP (or 1 in 100 year event) fluvial flood level plus an allowance for climate change assuming a 20% increase in flow over the next 100 years.

For coastal flood risk, floor levels should be raised above the 0.5% AEP (or 1 in 200 year event) plus climate change. Climate change predictions for rises in sea level vary across the country and should be based on Defra[3] guidance.

In addition, the design flood level should include a freeboard above the flood level. For non-residential development, e.g. commercial freeboard, the Environment Agency usually requires a freeboard of 300mm, and for residential development a freeboard of 600mm.

Compensatory Storage

Where development is proposed in undefended areas of floodplain, which lie outside of the functional floodplain, the implications of ground raising operations for flood risk elsewhere needs to be considered. Raising existing ground levels may reduce the capacity of the floodplain to accommodate floodwater and increase the risk of flooding by either increasing the depth of flooding to existing properties at risk or by extending the floodplain to cover properties normally outside of the floodplain. Flood storage capacity can be maintained by lowering ground levels either within the curtilage of the development or elsewhere in the floodplain, in order to maintain at least the same volume of flood storage capacity within the floodplain.

In undefended tidal areas, raising ground levels is unlikely to impact on maximum tidal levels so the provision of compensatory storage should not be necessary.

For development in a defended flood risk area, the impact on residual flood risk to other properties needs to be considered. New development behind flood defences can increase the residual risk of flooding if the flood defences are breached or overtopped by changing the conveyance of the flow paths or by displacing flood water elsewhere. If the potential impact on residual risk is unacceptable then mitigation should be provided.

Surface Water Drainage Assessment

Developers should demonstrate that the disposal of surface water from the site will not exacerbate existing flooding from new development within Flood Zones 3 and 2, development greater than 1Ha in Flood Zone 1 and within areas that are known to suffer from surface water drainage or sewer flooding.

[3] Flood and Coastal Defence Appraisal Guidance FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts. Defra, October 2006

A surface water drainage assessment should be undertaken to demonstrate that surface water runoff from the proposed development can be effectively managed without increasing flood risk elsewhere. A surface water drainage assessment should include the following:

- Assessment of whether the development will increase the overall discharge from the site by calculating the change in area covered by roofs and hard-standing.
- Details of how overland flow from the new development can be intercepted to prevent flooding of adjacent land.
- Details of how additional onsite surface water attenuation can be provided to mitigate against known flooding problems or as a result of incapacity on the drainage systems.
- Demonstration that overland flows will not increase flood risk to both existing development and receiving watercourses.
- Agreement that the rates of discharge from the development are acceptable to the Environment Agency and utilities authorities.

Selection of Appropriate Mitigation Measures

The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas. Where vulnerable development cannot be allocated within low risk areas then measures could be put in place to mitigate against the flood risk.

There are several sources of information on potential mitigation measures, as follows:

- Flood Risk Assessment Guidance for New Development, Environment Agency R&D (FD2320)
- Development and Flood Risk – Guidance for the Construction Industry, CIRIA 624

The Environment Agency R&D Guidance on Flood Risk Assessments for new development suggests that mitigation measures can be split into three types:

- Measures that reduce the physical hazard, e.g. through raised defences or flood storage
- Measures that reduce the exposure to the hazard, e.g. raise properties above flood levels
- Measures that reduce the vulnerability to the hazard, e.g. flood warning or emergency planning.

The selection of appropriate mitigation measures depends on the requirements of the development and its sensitivity to flood risk. Any mitigation measure selected should be sustainable in the future by taking into consideration the impact of climate change on flood risk. The residual risk of developing an area vulnerable to flooding with mitigation measures in place should also be considered.

<u>Flood defence walls or embankments</u>

Flood defences, fully funded by the development can be constructed to protect a new development from fluvial or coastal flood risk. However, the impact on the risk of flooding elsewhere with defences in place needs to be assessed and managed for example through compensatory storage. Residual risk of flooding with flood defences also needs to be assessed and managed.

It is acknowledged that this mitigation measure does introduce potential maintenance issues and as a result is not a favoured approach by the Environment Agency. If this measure is to be investigated, the site specific FRA should identify a long term maintenance plan and determine associated residual risks.

Chapter 6 of the PPS25 Practice Guide provides further advice on residual risk behind defences.

Flood Storage

Flood storage either offline or online can be used to manage water levels at or downstream of a development site where the site is potentially at risk of fluvial flooding.

Building Design

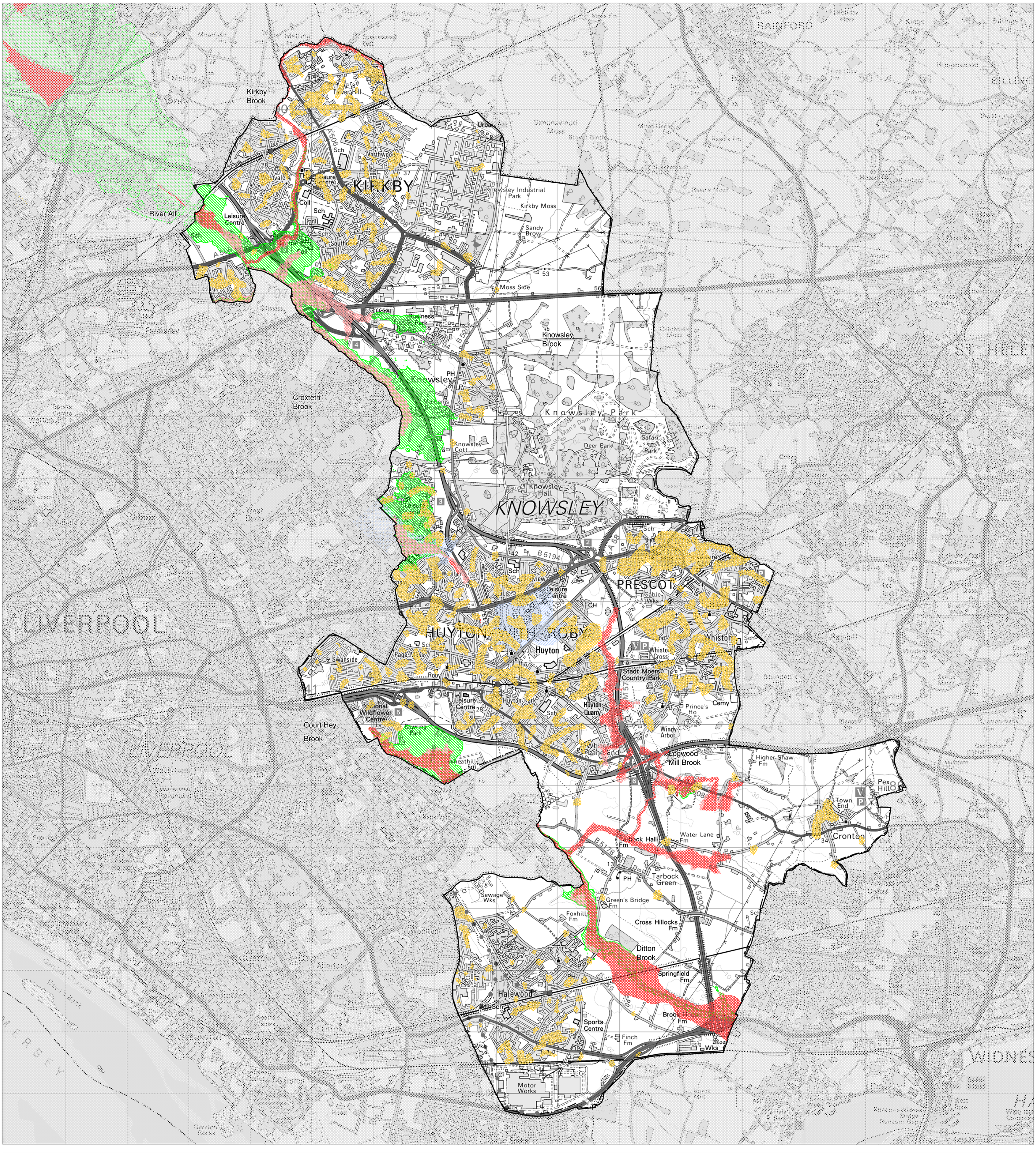
Flood management measures only manage the risk of flooding rather than remove it completely. Therefore, buildings should be designed to be flood resistant and flood resilient where they are built behind flood defence systems. Flood resistance is the prevention of flood water entering a building through, for example, flood barriers or raising floor levels. Flood resilience is ensuring the finish (e.g. type of flooring) and services (e.g. electrics) are such that following a flood the building can be returned quickly to its normal operation. A basic level of flood resistance and resilience can be achieved through good building practice and complying with Building Regulations (ODPM, 2000). Flood resistance and flood resilience measures can also mitigate against other sources of flooding, e.g. surface water.

Flood Warning

The Environment Agency provides flood warnings to a number of existing properties at risk of flooding to enable owners to protect life and manage the effect of flooding of their property. Flood warning should only be provided as a measure to manage residual risk from fluvial and coastal flooding and should not be used as the sole measure to offer protection to a development.

Access and Egress

PPS25 requires that safe access and escape is available to and from new developments in flood risk areas. Where possible, safe access routes should be located above design flood levels and an evacuation procedure should be in place for an extreme fluvial or tidal flood event. If no safe access can be provided then a safe haven should be provided within the development.



Legend:

- Knowsley Boundary
- Flood Zone 3b - High Risk
- Flood Zone 3a - High Risk
- Flood Zone 2 - High Risk
- Surface Water Flooding Indicated From Council Records - Medium Risk
- High Frequency Internal DG5 Surface Water Flooding - Medium Risk
- Potential Groundwater Flooding - Low Risk

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

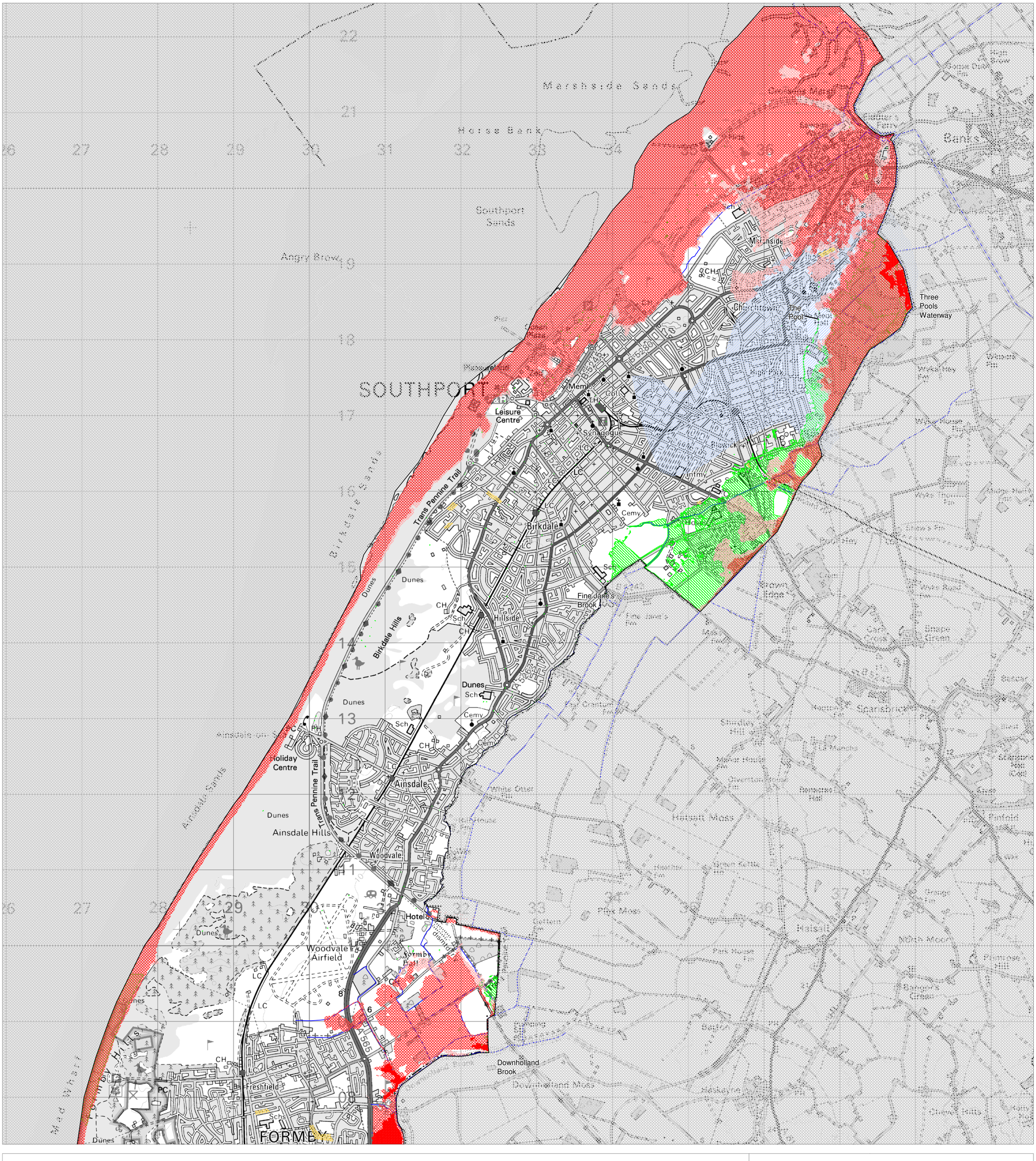
Combined Risk Matrix Map Knowsley

Document Ref: **5074164/DG/002**

Figure Ref: **J1**

Knowsley Council

ATKINS



Legend:

- Sefton Boundary
- Flood Zone 3b - High Risk
- Flood Zone 3a - High Risk
- Flood Zone 2 - High Risk
- Surface Water Flooding Indicated From Council Records - Medium Risk
- High Frequency Internal DG5 Surface Water Flooding - Medium Risk
- Potential Groundwater Flooding - Low Risk

SCALE: NTS

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

Combined Risk Matrix Map North Sefton

Document Ref: **5074164/62/DG/002**

Figure Ref: **J2**

Sefton Council

ATKINS

Legend:

- Sefton Boundary
- Flood Zone 3b - High Risk
- Flood Zone 3a - High Risk
- Flood Zone 2 - High Risk
- Surface Water Flooding Indicated From Council Records - Medium Risk
- High Frequency Internal DG5 Surface Water Flooding - Medium Risk
- Potential Groundwater Flooding - Low Risk

SCALE:

Project Title:

Knowsley and Sefton Strategic Flood Risk Assessment

Figure Title:

Combined Risk Matrix Map
South Sefton

Document Reference:

5074164/62/DG/002

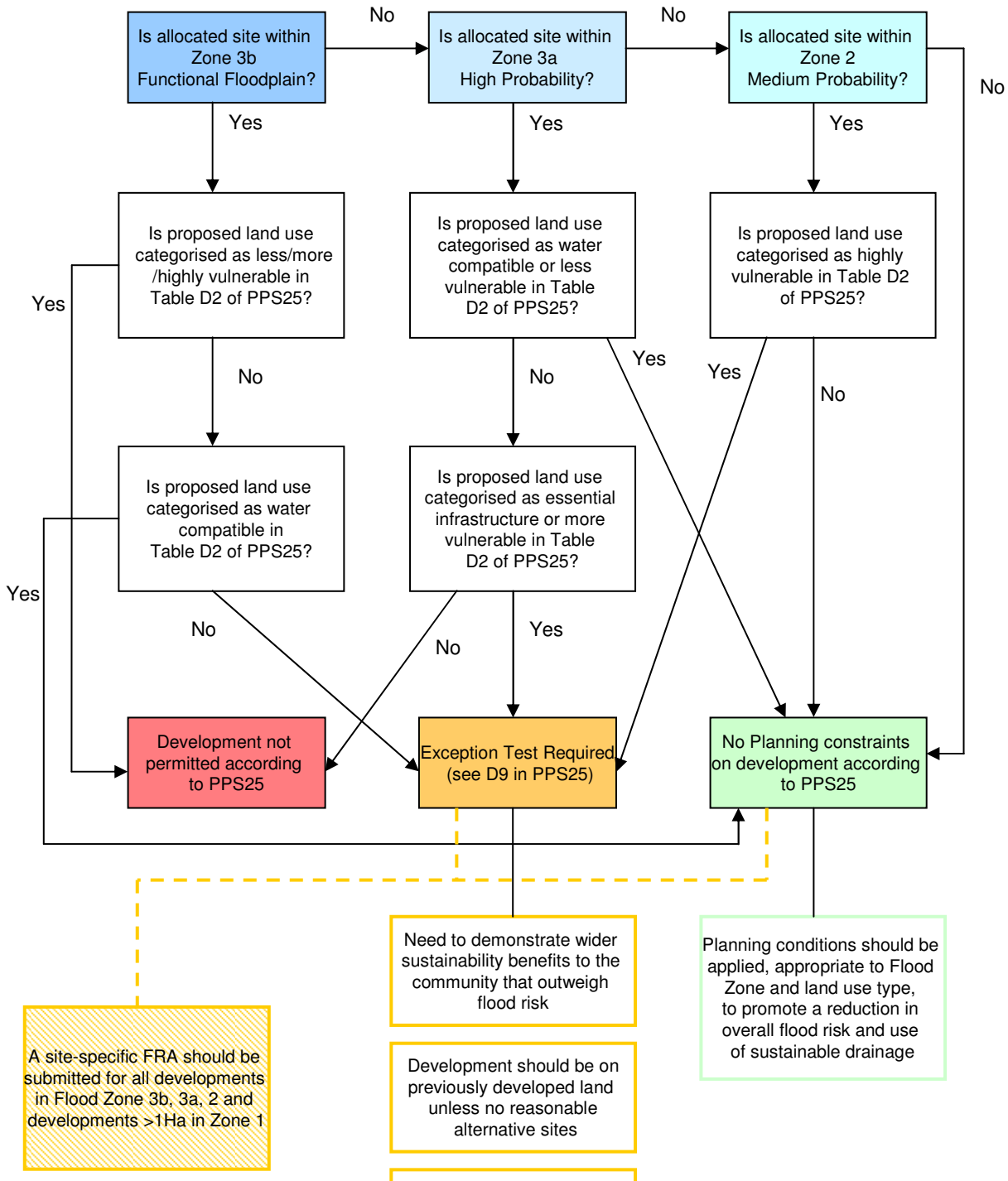
Figure Ref:

J3

Sefton Council

ATKINS

Planners from Knowsley Council and Sefton Council should carry out the Sequential Test (refer Section 6 of the SFRA) before considering the development of an allocated site



A site-specific FRA should be submitted for all developments in Flood Zone 3b, 3a, 2 and developments >1Ha in Zone 1

Need to demonstrate wider sustainability benefits to the community that outweigh flood risk

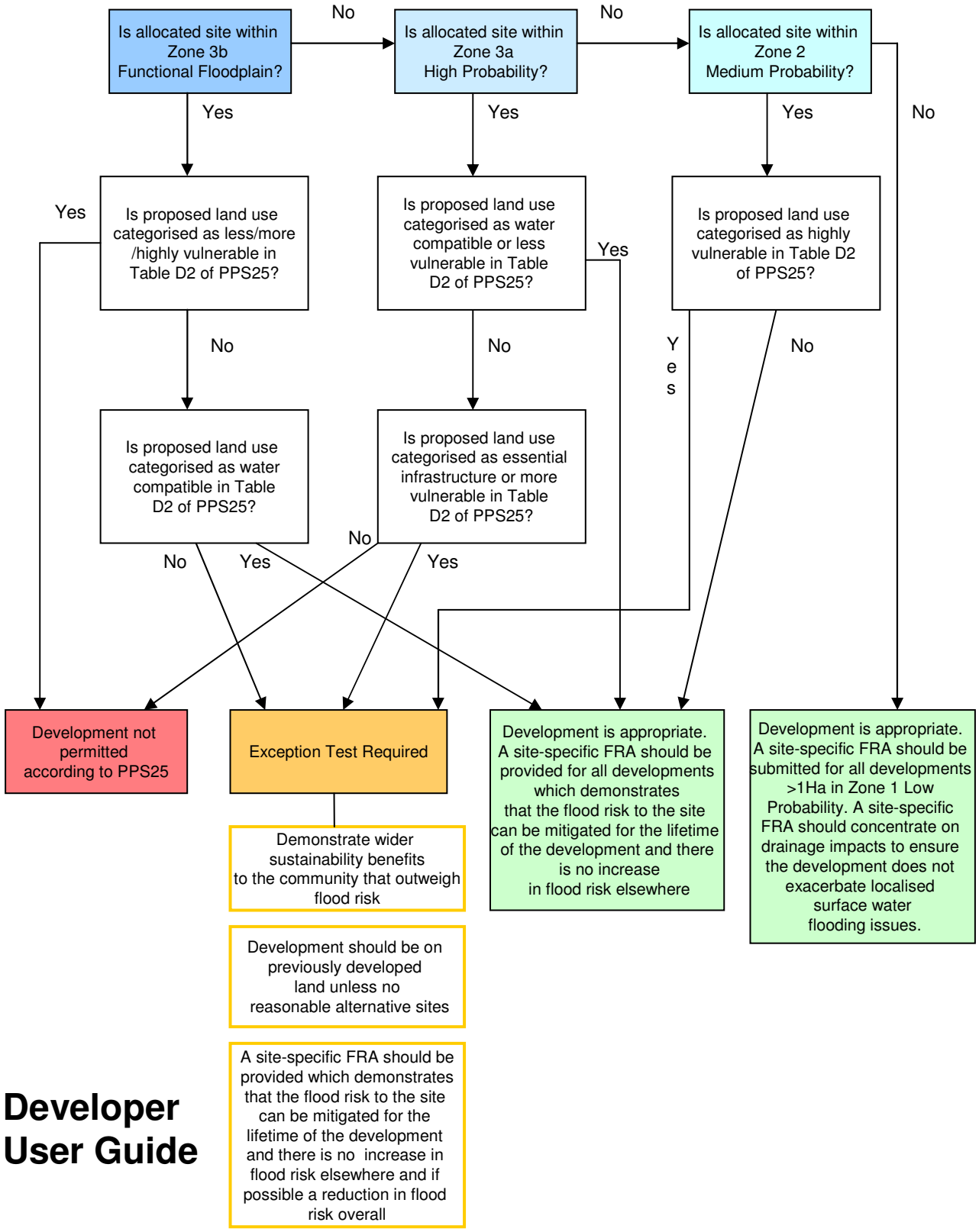
Development should be on previously developed land unless no reasonable alternative sites

Planning conditions should be applied to ensure development will be safe without increasing flood risk elsewhere and where possible will reduce flood risk overall

Planning conditions should be applied, appropriate to Flood Zone and land use type, to promote a reduction in overall flood risk and use of sustainable drainage

Knowsley Council and Sefton Council Planning User Guide

Unless development is proposed on an allocated site that has been included in
The SFRA then the Developer should carry out the Sequential Test (refer Section 6 of the SFRA) before considering the development of an allocated site



Developer User Guide

Guidance Notes for Developers

How to Use the Strategic Flood Risk Assessment

The Strategic Flood Risk Assessment is the assessment and categorisation of flood risk on a district wide basis in accordance with Planning Policy Statement 25 (PPS25)[1]. SFRAs refine information on the probability of flooding, taking other sources of flooding and the impacts of climate change into account. The SFRA provides the basis for applying the Sequential Test and the Exception Test where consideration needs to be given to the impact of the flood risk management infrastructure on the frequency, impact, speed of onset, depth and velocity of flooding within the Flood Zones considering a range of flood risk management maintenance scenarios.

A developer should consider flood risk issues at a site as early as possible. The SFRA can be used to provide an indication of the likely flood risk issues at a site from all sources of flooding. Developers should identify whether the development site has been allocated for that type of land use in the Local Development Documents. For allocated sites the SFRA can provide information on the application of the Sequential Test and where undertaken the Exception Test to see if the land use is appropriate.

When is a Flood Risk Assessment Required?

A Flood Risk Assessment (FRA) will be required to accompany planning applications for:

- any development proposals of 1 hectare or greater in Flood Zone 1
- any development proposals in Medium Probability Flood Zone 2
- any development proposals in High Probability Flood Zone 3

The FRA should identify and assess the risks of all sources of flooding to and from the development, taking into account climate change and demonstrate how the risk will be managed. Appendix B1 of the SFRA provides details on the flood zones for Knowsley and Sefton and Appendix B2 provides an indication of the likely flood extents taking into consideration the influence of climate change. Appendix D is a combined flood risk maps and provides an indication of risk from surface water and ground water flooding in addition to fluvial and tidal flooding.

A FRA will also be required where the proposed development or change of use to a more vulnerable class may be subject to other sources of flooding or where the Environment Agency, Internal Drainage Board and/or other bodies have indicated that there may be drainage problems.

Standard Flood Risk Management Guidance for Developers

The broad aim of the Planning Policy Statement 25 is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages of any development.

Responsibility for this assessment lies with developers and they must demonstrate the following:

- Whether the proposed development is likely to be affected by current or future flooding from any source (see Appendices B1, B2 and D).
- Whether the proposed development will increase flood risk elsewhere.
- Whether the measures proposed to deal with any flood risk are sustainable.

[1] Planning Policy Statement 25: Development and Flood Risk. Department for Communities and Local Government (December 2006)

The developer must prove to the Local Planning Authority and the Environment Agency that the existing flood risk or flood risk associated with the proposed development can be satisfactorily managed.

The detail to be provided by a FRA will depend on where the proposed site fits within the development framework, particularly on its justification against the sequential test, described in the SFRA.

Development should follow the standard flood risk assessment approach provided by the Environment Agency and Ciria, as follows:

- National Standing Advice to Local Planning Authorities for Planning Applications - Development and Flood Risk in England' (June 2004)
- CIRIA Report C624 "Development and Flood Risk – Guidance for the Construction Industry" (2004).

The general requirements of a FRA are listed in Appendix E of PPS25 and within the Practice Guide to PPS25. Further guidance on the level of detail required for a FRA can be found in the Environment Agency's Flood Risk Assessment guidance notes available at http://www.environment-agency.gov.uk/research/planning/33098.aspx.

Guidance for Development within Each Flood Zone

An FRA should be commensurate with the risk of flooding to the proposed development. For example, where the risk of flooding of the site is negligible (Zone 1 Low Probability) there is little benefit to be gained in assessing the potential risk to life and/or property as a result of flooding. The particular requirements for FRAs within each of the flood zones delineated within PPS25 are outlined below.

Flood Zone 1 Low Probability

There are generally no flood risk related constraints placed upon future development within Zone 1 Low Probability according to PPS25; however it is important to recognise that if development is not carefully managed within this zone it may adversely affect the existing flooding regime.

The risks of alternative sources of flooding (e.g. groundwater, pluvial) need to be considered Appendix D provides an indication of the risk of flooding from other sources whilst Section 3.4 and 3.5 of the SFRA Report outlines the flood risk sources for Knowsley and Sefton respectively. The proposed development should also consider surface water runoff to ensure that there are no detrimental effects to existing development and where possible the runoff is reduced through sustainable drainage systems.

Flood Zone 2 Medium Probability

To satisfy the requirements of the Sequential Test, PPS25 recommends that development within Flood Zone 2 should be restricted to 'essential infrastructure', 'water compatible', 'more vulnerable' or 'less vulnerable' land uses.

Where non-flood risk related planning matters dictate that highly vulnerable development should be considered further within Flood Zone 2 it will be necessary to carry out the Exception Test.

PPS states that for the Exception Test to be passed:

1. *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.*
2. *the development should be on developable, previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and*

3. *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

The risks of alternative sources of flooding (e.g. groundwater, pluvial) need to be considered and Appendix D provides an indication of the risk of flooding from other sources. The proposed development should consider surface water runoff to ensure that there are no detrimental effects to existing development and where possible the runoff is reduced through sustainable drainage systems.

As part of the FRA, it will be necessary to demonstrate that the residual risk of flooding can be effectively managed and a planned evacuation route or safe haven can be provided.

Flood Zone 3a High Probability

To satisfy the requirements of the Sequential Test, PPS25 recommends that development within Flood Zone 3a should be restricted to 'Less Vulnerable' and 'Water Compatible' land uses.

Where non-flood risk related planning matters dictate that 'more vulnerable' vulnerable development and 'Essential Infrastructure' should be considered further within Flood Zone 3a it will be necessary to carry out the Exception Test (see above for details).

An FRA should include the following:

- The vulnerability of the development to fluvial and/or tidal flooding as well as other sources.
- The impact of climate change over the lifetime of the development on the flooding regime, i.e. maximum water levels, flood extents and flow paths.
- The effect of the new development on surface water runoff ensuring that there are no detrimental effects to existing development and where possible that runoff is reduced through sustainable drainage systems.
- Demonstration that residual risks of flooding, after existing and proposed flood management and mitigation measures are taken into account, are acceptable.
- Demonstration that dry access can be provided to enable the safe evacuation in the case of flooding or where this is not achievable a safe haven can be provided.

Flood Zone 3b Functional Floodplain

To satisfy the requirements of the Sequential Test, PPS25 recommends that development within Flood Zone 3b should be restricted to 'water compatible' land uses.

Where non-flood risk related planning matters dictate that 'Essential Infrastructure' should be considered further within Flood Zone 3b it will be necessary to carry out the Exception Test (see above for details).

An FRA should include the following:

- The vulnerability of the development to fluvial and/or tidal flooding as well as other sources.
- The impact of climate change over the lifetime of the development on the flooding regime, i.e. maximum water levels, flood extents and flow paths.
- The effect of the new development on surface water runoff ensuring that there are no detrimental effects to existing development and where possible that runoff is reduced through sustainable drainage systems.
- Demonstration that residual risks of flooding, after existing and proposed flood management and mitigation measures are taken into account, are acceptable.
- Demonstration that dry access can be provided to enable the safe evacuation in the case of flooding or where this is not achievable a safe haven can be provided.

Additional Guidance

Undefended Floodplain

Areas at risk of fluvial flooding need to be assessed against the 1% annual exceedance probability (AEP) or 1 in 100 year event criteria with 0.5% AEP or 1 in 200 year event criteria for tidal flooding. The Environment Agency's hydraulic models may be made available for use by developers to determine the site's vulnerability to flooding. The developer will need to firstly ensure that the models are fit for purpose and sufficiently detailed to provide an accurate understanding of flood risk to the site. If existing models are not available, then a developer will need to assess the extent and requirements of any modelling work that is required. Detailed hydraulic modelling will involve the following:

- Carrying out a hydrological assessment using Flood Estimation Handbook techniques and using gauging records where available.
- Constructing an in-bank model using up to date survey data including structures, e.g. bridges, weirs, culverts and sluices.
- Extending the in-bank model to include floodplains where necessary using appropriate hydraulic modelling approaches to replicate the extent, storage and conveyance of the floodplains, e.g. through extended cross sections, reservoir units or 2-D modelling.
- Calibrating or verifying the hydraulic model where hydrometric monitoring data or flood records are available.
- Carrying out sensitivity analysis to confirm modelling assumptions and assess climate change impacts.
- Mapping of flooding extents

Defended Floodplain

Development sites within a defended tidal or fluvial floodplain are at particular risk due to the risk of the defences being overtopped or breached, resulting in the rapid onset of fast flowing and deep water flooding with little or no warning.

Residual risk from the breach or overtopping of defences needs to be considered as part of a FRA. Defra's[2] Flood Risk Assessment Guidance for New Development provides guidance on the level of risk related to distance and flood depth for overtopping and breaching scenarios.

The objectives of a breach analysis are as follows:
- to determine the Rapid Inundation Zone where there is a potential risk to life
- to investigate the impact of the proposed development on the flood risk to others
- to test the effectiveness of mitigation measures

Consideration of flood risk behind defences should take into consideration the standard of protection and design freeboard of the flood defence along with its condition and potential mechanisms of failure. The parameters of a breach in terms of potential location, width and invert level as well as the duration of a flood event should be agreed with the Environment Agency prior to any analysis.

In Sefton, areas benefiting from defences are shown to the north of Southport and the south of Formby and are shown in Appendix A3. Consideration should be given to the breach and overtopping of the defences and coastal dunes whilst considering the influence of the Alt and Crossens pumping stations.

[2] Flood Risk Assessment Guidance for New Development Phase 2: Framework and guidance for Assessing and Managing Flood Risk for New Development – Full Documentation and Tools. R&D Technical Report FD2320/TR2. Defra/Environment Agency 2005

There are no areas within Knowsley that benefit from formal EA flood defence assets although there are raised linear embankments which provide less than a 1% AEP (1 in 100 year event) flood defence provision.

Therefore, for Sefton and Knowsley, where the existing defences have a standard of protection less than 1% Annual Exceedance Probability (AEP) (1 in 100 year event) they may be overtopped and even submerged during a 1% AEP (1 in 100 year event) flood event and out of bank flow will occur in a manner almost as if no defences existed.

Design Floor Levels

It may be feasible to reduce the risk to a development through raising the ground level above the level of flood risk.

Floor levels should be raised above the 1% AEP (or 1 in 100 year event) fluvial flood level plus an allowance for climate change assuming a 20% increase in flow over the next 100 years.

For coastal flood risk, floor levels should be raised above the 0.5% AEP (or 1 in 200 year event) plus climate change. Climate change predictions for rises in sea level vary across the country and should be based on Defra[3] guidance.

In addition, the design flood level should include a freeboard above the flood level. For non-residential development, e.g. commercial freeboard, the Environment Agency usually requires a freeboard of 300mm, and for residential development a freeboard of 600mm.

Compensatory Storage

Where development is proposed in undefended areas of floodplain, which lie outside of the functional floodplain, the implications of ground raising operations for flood risk elsewhere needs to be considered. Raising existing ground levels may reduce the capacity of the floodplain to accommodate floodwater and increase the risk of flooding by either increasing the depth of flooding to existing properties at risk or by extending the floodplain to cover properties normally outside of the floodplain. Flood storage capacity can be maintained by lowering ground levels either within the curtilage of the development or elsewhere in the floodplain, in order to maintain at least the same volume of flood storage capacity within the floodplain.

In undefended tidal areas, raising ground levels is unlikely to impact on maximum tidal levels so the provision of compensatory storage should not be necessary.

For development in a defended flood risk area, the impact on residual flood risk to other properties needs to be considered. New development behind flood defences can increase the residual risk of flooding if the flood defences are breached or overtopped by changing the conveyance of the flow paths or by displacing flood water elsewhere. If the potential impact on residual risk is unacceptable then mitigation should be provided.

Surface Water Drainage Assessment

Developers should demonstrate that the disposal of surface water from the site will not exacerbate existing flooding from new development within Flood Zones 3 and 2, development greater than 1Ha in Flood Zone 1 and within areas that are known to suffer from surface water drainage or sewer flooding.

[3] Flood and Coastal Defence Appraisal Guidance FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts. Defra, October 2006

A surface water drainage assessment should be undertaken to demonstrate that surface water runoff from the proposed development can be effectively managed without increasing flood risk elsewhere. A surface water drainage assessment should include the following:

- Assessment of whether the development will increase the overall discharge from the site by calculating the change in area covered by roofs and hard-standing.
- Details of how overland flow from the new development can be intercepted to prevent flooding of adjacent land.
- Details of how additional onsite surface water attenuation can be provided to mitigate against known flooding problems or as a result of incapacity on the drainage systems.
- Demonstration that overland flows will not increase flood risk to both existing development and receiving watercourses.
- Agreement that the rates of discharge from the development are acceptable to the Environment Agency and utilities authorities.

Selection of Appropriate Mitigation Measures

The sequential approach should be applied within development sites to locate the most vulnerable elements of a development in the lowest risk areas. Where vulnerable development cannot be allocated within low risk areas then measures could be put in place to mitigate against the flood risk.

There are several sources of information on potential mitigation measures, as follows:

- Flood Risk Assessment Guidance for New Development, Environment Agency R&D (FD2320)
- Development and Flood Risk – Guidance for the Construction Industry, CIRIA 624

The Environment Agency R&D Guidance on Flood Risk Assessments for new development suggests that mitigation measures can be split into three types:

- Measures that reduce the physical hazard, e.g. through raised defences or flood storage
- Measures that reduce the exposure to the hazard, e.g. raise properties above flood levels
- Measures that reduce the vulnerability to the hazard, e.g. flood warning or emergency planning.

The selection of appropriate mitigation measures depends on the requirements of the development and its sensitivity to flood risk. Any mitigation measure selected should be sustainable in the future by taking into consideration the impact of climate change on flood risk. The residual risk of developing an area vulnerable to flooding with mitigation measures in place should also be considered.

<u>Flood defence walls or embankments</u>

Flood defences, fully funded by the development can be constructed to protect a new development from fluvial or coastal flood risk. However, the impact on the risk of flooding elsewhere with defences in place needs to be assessed and managed for example through compensatory storage. Residual risk of flooding with flood defences also needs to be assessed and managed.

It is acknowledged that this mitigation measure does introduce potential maintenance issues and as a result is not a favoured approach by the Environment Agency. If this measure is to be investigated, the site specific FRA should identify a long term maintenance plan and determine associated residual risks.

Chapter 6 of the PPS25 Practice Guide provides further advice on residual risk behind defences.

Flood Storage

Flood storage either offline or online can be used to manage water levels at or downstream of a development site where the site is potentially at risk of fluvial flooding.

Building Design

Flood management measures only manage the risk of flooding rather than remove it completely. Therefore, buildings should be designed to be flood resistant and flood resilient where they are built behind flood defence systems. Flood resistance is the prevention of flood water entering a building through, for example, flood barriers or raising floor levels. Flood resilience is ensuring the finish (e.g. type of flooring) and services (e.g. electrics) are such that following a flood the building can be returned quickly to its normal operation. A basic level of flood resistance and resilience can be achieved through good building practice and complying with Building Regulations (ODPM, 2000). Flood resistance and flood resilience measures can also mitigate against other sources of flooding, e.g. surface water.

Flood Warning

The Environment Agency provides flood warnings to a number of existing properties at risk of flooding to enable owners to protect life and manage the effect of flooding of their property. Flood warning should only be provided as a measure to manage residual risk from fluvial and coastal flooding and should not be used as the sole measure to offer protection to a development.

Access and Egress

PPS25 requires that safe access and escape is available to and from new developments in flood risk areas. Where possible, safe access routes should be located above design flood levels and an evacuation procedure should be in place for an extreme fluvial or tidal flood event. If no safe access can be provided then a safe haven should be provided within the development.

Culverts in Knowsley - Environment Agency NFCDD data and data held by Knowsley Council

Culvert Location	Grid Reference	Standard of defence	Source
Start of long culvert under Brook Hey Road	SJ4149899808	100	NFCDD table
Under playing field and Brook Hey Road - to Simonswood Lane	SJ4152299802	50	NFCDD table
M57 Culvert	SJ4030497668	100	NFCDD table
At point were old sea embankment joins new embankment.	SD3732020890	50	NFCDD table
Under the Sluice adjacent to track off Water lane	SD3816620427	75	NFCDD table
Under Crossens Pumping Station Field	SD3770620623	50	NFCDD table
On Hesketh golf course just upstream of the public footpath between Stanley School and the golf course	SD3539319624	150	NFCDD table
Rear of embankment at corner of ETW compound to	SD3670820647	150	NFCDD table
Culvert Outlet at rear of Melrose Ave to Mr Limit Dawlish Drive.	SD3688820346	150	NFCDD table
Under Harogate Way & Marine Drive	SD3735320746	150	NFCDD table
Gorsey Lane	SD4046421348	50	NFCDD table
Ralphs Wifes Lane	SD3860020855	50	NFCDD table
CU EXIT-CU ENTRY	SD4039220847	50	NFCDD table
-	SD4027921211	50	NFCDD table
Rimmers Farm Vicarage Lane to Bonds Lane	SD3883621057	75	NFCDD table
CU EXIT-CU ENTRY	SD3898720044	50	NFCDD table
CU EXIT-CU ENTRY	SD3864620176	50	NFCDD table
-	SD3873620576	75	NFCDD table
CU EXIT-CU ENTRY	SD3912620499	50	NFCDD table
CU EXIT-CU ENTRY	SD3912320505	50	NFCDD table
-	SD4061219312	50	NFCDD table
Mere Brow	SD4077718630	50	NFCDD table
-	SD4029019234	50	NFCDD table
--	SD3858820012	25	NFCDD table
A565-	SD4192418955	50	NFCDD table
-	SD4277418886	50	NFCDD table
-	SD4283618917	50	NFCDD table
-	SD4331319368	N/A	NFCDD table
A565-A565	SD4346319416	N/A	NFCDD table
End of open channel, adjacent to the Leigh Arms Pub to mr limit.	SD4168218692	N/A	NFCDD table
Under access road from Gravel Lane, Mere Brow to The Lesuire Lakes	SD4154818483	N/A	NFCDD table
-	SJ4254696627	100	NFCDD table
A580 East Lancs Road & empty ground adjacent to Coopers Lane Culvert	SJ4348896850	100	NFCDD table
M57 Culvert	SJ4106496922	100	NFCDD table
A580 East Lancs Road Culvert	SJ4158396757	100	NFCDD table
Under/through industrial estate.	SJ4274196418	100	NFCDD table
Alder Lane Sewage Pumping Station to Tithebarn Road.	SJ4314595008	50	NFCDD table
Rear of No 29 Ormskirk Road.	SJ4402895356	50	NFCDD table
Outfall at land off Hare Croft to Stockbridge Grid	SJ4186893781	50	NFCDD table

M57 Culvert	SJ4305294225	100	NFCDD table
Alder Lane (1st House)	SJ4260695068	50	NFCDD table
Alder Lane	SJ4263595052	50	NFCDD table
Alder Lane along wood.	SJ4273695026	50	NFCDD table
Motorway M57 off Alder Lane	SJ4282194989	50	NFCDD table
16/05/LONB/001/B/0012/FM/1	SJ4655996570	50	Knowsleydefences table
16/05/LONB/001/B/0012/FM/1. Farmbridge.	SJ4655896572	50	Knowsleydefences table
15/05/NETH/001/B/0024/CU/1Culvert	SJ4460589595	50	Knowsleydefences table
Roadbridge.	SJ4610592155	50	Knowsleydefences table
15/05/STON/001/B/0013/RB/1. Roadbridge.	SJ4752287291	50	Knowsleydefences table
15/05/FOXB/001/B/0014/RB/1. Roadbridge	SJ4814489098	50	Knowsleydefences table
15/05/LOGW/001/B/0009/RB/1. Precast concrete flatdeck roadbridge.	SJ4597288167	50	Knowsleydefences table
15/05/STON/001/B/0005/FM/1Farm Bridge	SJ4561587146	50	Knowsleydefences table
15/05/STON/001/B/0010/RB/1. Culvert	SJ4639687502	100	Knowsleydefences table
15/05/STON/001/B/0015/FM/1Farm Bridge	SJ4695787397	50	Knowsleydefences table
Road Bridge	SJ4707987378	50	Knowsleydefences table
15/05/SPRG/001/B/0008/RB/1. Farmbridge,	SJ4731385951	50	Knowsleydefences table
Culvert.	SJ4749085764	50	Knowsleydefences table
Footbridge. 15/05/LOGW/001/B/0053/FB/1.	SJ4575791427	50	Knowsleydefences table
Footbridge	SJ4545387320	50	Knowsleydefences table
15/05/HAL3/001/B/0007/FM/1. Farmbridge.	SJ4374487109	50	Knowsleydefences table
Farmbridge. 15/05/HUY1/001/B/0004/FM/1.	SJ4323289485	50	Knowsleydefences table
Road bridge. 15/05/LOGW/001/B/0023/CU/1.	SJ4662689204	50	Knowsleydefences table
Road bridge. 15/05/LOGW/001/B/0030/CU/1.	SJ4642489547	50	Knowsleydefences table
Road bridge. 15/05/LOGW/001/B/0045/CU/1.	SJ4580890955	50	Knowsleydefences table
Farm bridge	SJ4732389034	50	Knowsleydefences table
15/05/DITT/002/B/0015/FB/1. Steel/iron flatdeck footbridge	SJ4702385455	100	Knowsleydefences table
15/05/DOG1/001/B/0028/RB/1. Roadbridge	SJ4854188331	50	Knowsleydefences table
15/05/DOG1/001/B/0046/FM/1. Farmbridge	SJ4974089074	50	Knowsleydefences table
Culvert15/05/BRUN/001/B/0005/FM/1	SJ4699088213	50	Knowsleydefences table
Footbridge. 15/05/COUH/001/B/0008/FB/1.	SJ4206689785	50	Knowsleydefences table

Road Bridge15/05/ALDB/001/B/0008/RB/1	SJ4837187403	50	Knowsleydefences table
15/05/DOG1/001/B/0024/FM/1. Farmbridge	SJ4825788029	50	Knowsleydefences table
15/05/DOG1/001/B/0038/RB/1. Roadbridge	SJ4940688671	50	Knowsleydefences table
Culvert. - road bridge15/05/ALDB/001/B/0010/CU/1	SJ4947687795	50	Knowsleydefences table
15/05/DOG1/001/B/0004/RB/1. Roadbridge	SJ4686887887	50	Knowsleydefences table
15/05/DOG1/001/B/0011/RB/1. Masonry arched roadbridge	SJ4767587823	5	Knowsleydefences table
15/05/DOG1/001/B/0014/RB/1. Roadbridge.	SJ4799087909	50	Knowsleydefences table
Footbridge. 15/05/COUH/001/B/0009/FB/1.	SJ4200790022	50	Knowsleydefences table
15/05/DITT/002/B/0017/RA/1. Railbridge	SJ4623885919	100	Knowsleydefences table
Farm Bridge	SJ4705389179	50	Knowsleydefences table
Culvert15/05/BRUN/001/B/0004/FM/1	SJ4694288227	50	Knowsleydefences table
Culvert. 15/05/FOXB/001/B/0006/FM/1Road bridge	SJ4787189088	50	Knowsleydefences table
15/05/FOXB/001/B/0010/FM/1Farm Bridge	SJ4705589178	50	Knowsleydefences table
15/05/FOXB/001/B/0011/CU/1	SJ4705189154	50	Knowsleydefences table
15/05/FOXB/001/B/0017/FM/1Farm bridge	SJ4868189035	50	Knowsleydefences table
Farm bridge	SJ4706689176	50	Knowsleydefences table
15/05/DOG1/001/B/0048/FM/1. Farmbridge	SJ4987289197	50	Knowsleydefences table
15/05/DOG1/001/B/0050/FB/1. Precast concrete flatdeck footbridge.	SJ5010289310	50	Knowsleydefences table
Farmbridge	SJ4832388065	50	Knowsleydefences table
15/05/LOGW/001/B/0006/RB/1. Roadbridge	SJ4537688140	50	Knowsleydefences table
15/05/LOGW/001/B/0007/RB/1. Precast concrete flatdeck roadbridge.	SJ4541388158	50	Knowsleydefences table
Farmbridge. 15/05/LOGW/001/B/0013/FM/1.	SJ4612388086	50	Knowsleydefences table
Footbridge. 15/05/LOGW/001/B/0017/FM/1.	SJ4620588150	50	Knowsleydefences table
Farmbridge. 15/05/LOGW/001/B/0018/FM/1.	SJ4631288464	50	Knowsleydefences table
Culvert. 15/05/LOGW/001/B/0027/CU/1.	SJ4656989393	50	Knowsleydefences table
15/05/DOG1/001/B/0043/CU/1. Culvert	SJ4961488722	50	Knowsleydefences table
15/05/DOG1/001/B/0047/FM/1. Farmbridge	SJ4975889131	50	Knowsleydefences table
15/05/HAL3/001/B/0009/FM/1. Farmbridge.	SJ4354187051	50	Knowsleydefences table
Culvert. 15/05/HUY1/001/B/0009/CU/1.	SJ4357989713	50	Knowsleydefences table
15/05/HAL1/001/B/0005/FM/1.	SJ4503487358	50	Knowsleydefences

Farmbridge.			table
15/05/HAL1/001/B/0006/RB/1.			Knowsleydefences
Farmbridge.	SJ4492787451	50	table
			Knowsleydefences
15/05/HAL3/001/B/0003/FB/1. Footbridge.	SJ4359587454	50	table
15/05/NETH/001/B/0004/RB/1Road			Knowsleydefences
Bridge	SJ4556386651	50	table
			Knowsleydefences
15/05/NETH/001/B/0008/FB/1Footbridge	SJ4551187145	50	table
15/05/NETH/001/B/0015/RB/1Road			Knowsleydefences
Bridge	SJ4465688345	50	table
15/05/NETH/001/B/0023/FM/1.			Knowsleydefences
Farmbridge	SJ4449489521	50	table
			Knowsleydefences
Culvert. 15/05/LOGW/001/B/0061/CU/1.	SJ4594391869	50	table
			Knowsleydefences
Culvert	SJ4576991013	50	table
			Knowsleydefences
Road bridge.	SJ4587290229	50	table
			Knowsleydefences
Culvert	SJ4591392672	50	table
Road bridge.			Knowsleydefences
15/05/LOGW/001/B/0033/CU/1.	SJ4629789591	50	table
Road			Knowsleydefences
bridge.15/05/LOGW/001/B/0037/RB/1.	SJ4606489739	50	table
			Knowsleydefences
Culvert. 15/05/LOGW/001/B/0044/CU/1.	SJ4582590835	50	table
Road bridge.			Knowsleydefences
15/05/LOGW/001/B/0051/RB/1.	SJ4572591328	50	table
Footbridge.			Knowsleydefences
15/05/LOGW/001/B/0052/FB/1.	SJ4575091379	50	table
Footbridge.			Knowsleydefences
15/05/LOGW/001/B/0055/FB/1.	SJ4574391526	50	table
Farmbridge.			Knowsleydefences
15/05/LOGW/001/B/0057/FM/1.	SJ4576791587	50	table
Footbridge.			Knowsleydefences
15/05/LOGW/001/B/0058/FB/1.	SJ4580291633	50	table
			Knowsleydefences
15/05/NETH/001/B/0027/CU/1Culvert	SJ4466289635	50	table
			Knowsleydefences
Farm bridge	SJ4726086023	50	table
			Knowsleydefences
15/05/SPRI/001/B/0003/FB/1. Footbridge.	SJ4767985487	50	table
			Knowsleydefences
15/05/SPRI/001/B/0009/CU/1. Culvert.	SJ4712686101	50	table
			Knowsleydefences
Culvert.	SJ4771785238	50	table
			Knowsleydefences
Culvert.	SJ4572392838	50	table
Farm			Knowsleydefences
Bridge15/05/WOOD/001/B/0004/FM/1	SJ4550586634	50	table
			Knowsleydefences
Footbidge15/05/WOOD/001/B/0010/FB/1	SJ4513786580	50	table
			Knowsleydefences
Footbridge15/05/WOOD/001/B/0012/FM/1	SJ4503786481	50	table
15/05/STON/001/B/0007/RB/1.			Knowsleydefences
Roadbridge.	SJ4572987222	50	table
			Knowsleydefences
Farm Bridge	SJ4632787509	50	table
15/05/DOG1/001/B/0018/FM/1.	SJ4814187965	50	Knowsleydefences

Farmbridge			table
Culvert15/05/BRUN/001/B/0001/CU/1	SJ4658387972	50	Knowsleydefences table
Farm bridge15/05/WOOD/001/B/0005/FM/1.	SJ4536786602	20	Knowsleydefences table
Footbridge	SJ4798387908	50	Knowsleydefences table
Farm Bridge	SJ4704287375	0	Knowsleydefences table
Culvert. 15/05/DOG1/001/B/0033/CU/1	SJ4928288518	50	Knowsleydefences table
15/05/DOG1/001/B/0031/FM/1. Farmbridge	SJ4879188494	50	Knowsleydefences table
Farm bridge	SJ4859789372	50	Knowsleydefences table
15/05/FOXB/001/B/0004/RB/1. Culvert.	SJ4693389077	50	Knowsleydefences table
Footbridge. 15/05/LOGW/001/B/0042/RB/1.	SJ4594790346	50	Knowsleydefences table
Road bridge.	SJ4648088780	50	Knowsleydefences table
15/05/LOGW/001/B/0059/FM/1. Flat deck timber farm bridge.	SJ4589091803	50	Knowsleydefences table
Roadbridge	SJ4754085282	100	Knowsleydefences table
15/05/SPRI/001/B/0006/FM/1. Farmbridge.	SJ4753285742	50	Knowsleydefences table
15/05/HAL3/001/B/0006/FM/1. Farmbridge.	SJ4365787319	50	Knowsleydefences table
15/05/WOOD/001/B/0006/RB/1. Culvert.	SJ4528286557	50	Knowsleydefences table
Roadbridge	SJ4661687959	50	Knowsleydefences table
Footbridge. 15/05/LOGW/001/B/0004/FB/1.	SJ4537188116	50	Knowsleydefences table
Footbridge	SJ4781787811	50	Knowsleydefences table
Farm Bridge	SJ4765887243	0	Knowsleydefences table
Farm Bridge	SJ4778187169	0	Knowsleydefences table
Farm Bridge	SJ4791787108	0	Knowsleydefences table
Road Bridge	SJ4571686431	50	Knowsleydefences table
Regraded earth channel	SJ4574686409	50	Knowsleydefences table
Culvert	SJ4510587229	50	Knowsleydefences table
Farmbridge	SJ4519787143	50	Knowsleydefences table
Culvert	SJ4554786650	50	Knowsleydefences table
Footbridge	SJ4893888463	50	Knowsleydefences table
Pipe culvert	SJ4799787062	0	Knowsleydefences table
Farmbridge.	SJ4340789634	50	Knowsleydefences table
Roadbridge.	SJ4589392716	50	Knowsleydefences

			table
Culvert.	SJ4586892754	50	Knowsleydefences table
Farmbridge	SJ4581292766	50	Knowsleydefences table
Farmbridge.	SJ4573492912	50	Knowsleydefences table
Culvert	SJ4574293194	50	Knowsleydefences table
Footbridge.	SJ4571493273	50	Knowsleydefences table
Culvert.	SJ4570893367	50	Knowsleydefences table
Culvert.	SJ4572693544	50	Knowsleydefences table
Road bridge. 15/05/LOGW/001/B/0019/RB/1.	SJ4658489060	50	Knowsleydefences table
Farm Bridge	SJ4681189004	0	Knowsleydefences table
Farm Bridge	SJ4685989046	0	Knowsleydefences table
Culvert.	SJ4491886395	50	Knowsleydefences table
Culvert	SJ4716887766	50	Knowsleydefences table
Culvert	SJ4717087769	50	Knowsleydefences table
Culvert	SJ4720987839	50	Knowsleydefences table
Culvert	SJ4735687774	50	Knowsleydefences table
Culverted Channel	SJ4717287763	50	Knowsleydefences table
Culverted Channel	SJ4735987776	50	Knowsleydefences table
Culvert	SJ4668888216	50	Knowsleydefences table
Culvert	SJ4677488179	50	Knowsleydefences table
Culvert	SJ4678288228	50	Knowsleydefences table
Culvert	SJ4713988218	50	Knowsleydefences table

Defences in Knowsley - Environment Agency NFCDD data and data held by Knowsley Council

Defence Location	Grid Reference	Standard of defence	Source
-	SJ4115199692	N/A	NFCDD
Marine drive to bend and change in profile in embankment.	SD3714820857	150	NFCDD
Old embankment that joins new bank to watercourse 3 dissused outfall.	SD3729520878	75	NFCDD
Watercourse 3 dissused outfall to Georges Lane access ramp.	SD3718121102	75	NFCDD
Back Drain runs along Sluice to start of Centre Bank	SD3808120581	75	NFCDD
wooden access gates to wall adjacent to Banks Road.	SD3756920640	125	NFCDD
End of embankment adjacent to Banks Road to start of embankment near the large stone (Fiddlers Ferry).	SD3766520642	150	NFCDD
Fiddler's Ferry (large stone) to old embankment that joins new bank.	SD3771620721	75	NFCDD
Confluence with The Sluice to start of open channel adjacent to the large stone off Banks Road.	SD3773420742	50	NFCDD
Fairways to high ground at west side of Hesketh Road.	SD3425418516	150	NFCDD
End of embankment at west side of Hesketh Road to start of embankment at east side of Hesketh Road.	SD3468719137	150	NFCDD
Start of embankment at the east side of Hesketh Road to the end of Dawlish Drive.	SD3477519074	150	NFCDD
End of Dawlish Drive to Marine Drive.	SD3642420456	150	NFCDD
Bend and change in profile in embankment to wooden access gates.	SD3736220759	150	NFCDD
Start of embankment to bend at start of the wash embankment.	SD3762719272	50	NFCDD
3 Pools	SD3775519163	50	NFCDD
Water Lane road Bridge to end of Back Drain Wood Centre Bank 1st ramp	SD3823820320	50	NFCDD
Bonds Lane	SD3934421109	50	NFCDD
1st Ramp to Fishermans Plank	SD3857819732	50	NFCDD
Fishermans Plank to Ring Ditch Syphon	SD3887019230	50	NFCDD
Under the Sluice, at rear of tree nursery	SD3845319933	50	NFCDD
-	SJ4347196848	N/A	NFCDD
Start of Knowsley Wood to Farm Bridge rear of Randles Bridge Farm.	SJ4115096368	25	NFCDD
	SJ4115096366	50	NFCDD
Marshside Road to Millars Pace	SD3540020657	N/A	NFCDD
Millars Pace to Bank End, Marshside, Sefton	SD3617321141	20	NFCDD
Fairway to Hesketh Road	SD3408518942	20	NFCDD
Hesketh Road to Marshside Road	SD3450019400	20	NFCDD
Marshside	SD3522620458	N/A	NFCDD
Flood Bank15/05/DITT/002/L/0005/CB/1	SJ4783085184	100	Knowsleydefences table
Flood Bank15/05/DITT/002/R/0006/CB/1	SJ4781385182	100	Knowsleydefences table
15/05/FOXB/001/B/0005/WE/1Weir	SJ4694389116	50	Knowsleydefences table

Headland bank	SJ4780889513	0	Knowsleydefences table
Pump station from drain into Dog Clog 1.	SJ4716687763	50	Knowsleydefences table
Debris Screen	SJ4716787770	50	Knowsleydefences table
Flood Bank	SJ4701885453	50	Knowsleydefences table
Headland bank	SJ4607786146	50	Knowsleydefences table
Headland Bank. Earth flood bank.	SJ4574686409	50	Knowsleydefences table
15/05/DITT/002/L/0013/CB/1. Earth floodbank.	SJ4750785294	100	Knowsleydefences table
15/05/DITT/002/R/0014/CB/1. Earth floodbank.	SJ4750785284	100	Knowsleydefences table
Flood Bank	SJ4843387411	0	Knowsleydefences table
Flood Bank15/05/DOG1/001/R/0010/CB/1.	SJ4686787891	5	Knowsleydefences table
Flood Bank	SJ4758287793	50	Knowsleydefences table
Flood Bank	SJ4716787763	50	Knowsleydefences table
Raised.	SJ4767885487	50	Knowsleydefences table
Reservoir Embankment.	SJ4599291994	50	Knowsleydefences table

Culverts in Sefton - Environment Agency NFCDD data

Culvert Location	Grid Reference	Standard of defence	Source
Under Segars Lane and properties	SD3203212256	50	NFCDD table
Under Horse field and Moor Lane.	SD3162410309	50	NFCDD table
Dunnings Bridge Road culvert (A59)	SD3692700205	50	NFCDD table
From the end of the first open section to the begining of the second open section	SD3662503619	50	NFCDD table
Formby By Pass Culvert	SD3150104146	200	NFCDD table
	SD3200409079	50	NFCDD table
Under the Downholland embankment downstream of Cheshire Lines	SD3161008454	50	NFCDD table
Just downstream of Suttons Bridge	SD3113307802	50	NFCDD table
Under Downholland Brook Embankment	SD3118708174	50	NFCDD table
From end of open channel to mr limit (under Industrial estate)	SD3096906793	50	NFCDD table
Confluence with Downholland Brook to start of open channel	SD3118507122	50	NFCDD table
Adjacent to Downholland Brook	SD3113906334	50	NFCDD table
-	SD3034104197	100	NFCDD table
Orrell Hill Lane & Ground rear of Pheasant Pub.	SD3100003663	50	NFCDD table
Culvert under the Formby-By-Pass A565	SD3052009201	50	NFCDD table
End of open channel to mr limit	SD3084207187	50	NFCDD table
A565 Formby By Pass	SD3057008916	50	NFCDD table
End of open channel to mr limit (A565) Formby By-Pass	SD3081407903	50	NFCDD table
Southport Liverpool Rail Line	SD3020502126	50	NFCDD table
railway line to rear of property, adjacent to Hoggs Hill Lane.	SD2936205853	50	NFCDD table
River Alt to debris screen adjacent to railway	SD2945205597	200	NFCDD table
	SD2943805156	25	NFCDD table
Southport Liverpool Rail Line	SD2962605061	200	NFCDD table
A59 (Robbin's Bridge)	SD3844904208	70	NFCDD table
A59 Road Culvert	SD3743301477	50	NFCDD table
Rear of properties off Moorhey Road	SD3749400424	50	NFCDD table
Rear of properties off Moorhey Road, railway culvert.	SD3782600793	50	NFCDD table
M58 culvert	SD3840600928	50	NFCDD table
Weavers Lane Road Culvert	SD3880800830	50	NFCDD table
M57 motorway culvert.	SJ3816099300	N/A	NFCDD table
Culvert Under Canal.	SD3750605353	70	NFCDD table
End of short open length upstream of Hall Lane to start of open channel upstream of Alscot Close	SD3756001556	50	NFCDD table
Rear of property adjacent to Tommy Gent Way to culvert infall adjacent to playing field access road.	SD3762101588	50	NFCDD table
Leeds / Liverpool Canal.	SD3779101707	50	NFCDD table
Eastway road culvert and property gardens at each side of Eastway.	SD3831502001	50	NFCDD table
Rear of Brook Road	SD3822002018	50	NFCDD table
Culvert under Asda	SJ3709699993	70	NFCDD table
Dunnings Bridge South (A59 Northway) to M58.	SD3717200541	50	NFCDD table

A59 Northway, road culvert	SD3718900569	50	NFCDD table
Liverpool Road South	SD3732201441	N/A	NFCDD table
Liverpool Road South	SD3732401442	N/A	NFCDD table
Liverpool Road South	SD3733401448	N/A	NFCDD table
Liverpool Road South	SD3733401448	N/A	NFCDD table
Liverpool Road South	SD3736001463	50	NFCDD table
Culvert under New Cut Lane and properties.	SD3320613638	50	NFCDD table
Branch Channel confluence to 25m upstream	SD3356314142	50	NFCDD table
Under Crossens Pumping Station Field	SD3770620623	50	NFCDD table
On Hesketh golf course just upstream of the public footpath between Stanley School and the golf course	SD3539319624	150	NFCDD table
Rear of embankment at corner of ETW compound to	SD3670820647	150	NFCDD table
Culvert Outlet at rear of Melrose Ave to Mr Limit Dawlish Drive.	SD3688820346	150	NFCDD table
Under Harogate Way & Marine Drive	SD3735320746	150	NFCDD table

Defences in Sefton - Environment Agency NFCDD data

Defence Location	Grid Reference	Standard of defence	Source
Moor Hey Brook to dissmantled railway bridge (just downstream of A59)	SD3639200789	50	NFCDD table
Confluence with the River Alt to the first farm bridge, Chaple Lane.	SD3652600587	50	NFCDD table
Confluence with the River Alt to the first farm bridge, Chaple Lane.	SD3639200789	50	NFCDD table
just downstream of the Moor Hey Brook confluence to Moor Hey Brook confluence	SD3628700867	50	NFCDD table
Confluence with Dovers Brook to 34m upstream	SD3687101159	50	NFCDD table
Rear of Maghull High School	SD3685401186	50	NFCDD table
Start of embanked section to end of embanked section, opposite Harrisons Brook confluence	SD3566001599	50	NFCDD table
Harrisons Brook to end of embanked section	SD3559301545	50	NFCDD table
Confluence with St Helens Gutter to first farm bridge	SD3559301545	50	NFCDD table
start of embanked section to Harrisons Brook	SD3573801775	50	NFCDD table
St Helens Gutter to first farm bridge	SD3560801568	50	NFCDD table
End of garden centre to Bridges Lane, Road Bridge	SD3620001665	50	NFCDD table
From end of refuge collection centre to end of end of garden centre	SD3617501716	50	NFCDD table
Confluence with Maghull Brook to Rigby's Brook	SD3626603344	50	NFCDD table
First farm bridge to end of embankment , upstream of Moor Lane track	SD3555401572	50	NFCDD table
First farm bridge to end of embankment upstream of Moor Lane track.	SD3469902128	50	NFCDD table
Rear of refuge collection centre to end of garden centre	SD3612801892	50	NFCDD table
Pumping Station on Old Tip to Dovers Brook confluence	SD3581002252	50	NFCDD table
Maghull Brook to just downstream of the sewer pumping station	SD3561602531	50	NFCDD table
Opposit Maghull Brook	SD3558102489	50	NFCDD table
Foot Bridge to start of old landfill	SD3534202523	50	NFCDD table
Lunt Pumping Station to footbridge	SD3495002961	50	NFCDD table
Ince Pumping Station to Hunts Brook Outfall .	SD3288004535	50	NFCDD table
R. ALT-	SD3433903374	50	NFCDD table
Hunts Brook to Lunt Pumping Station (SETON MBC Station)	SD3495002961	50	NFCDD table
R. ALT-	SD3437303352	50	NFCDD table
Opposit Engine Cottages to start of Flood Embankment.	SD3249704906	50	NFCDD table
Start of Flood Embankment	SD3274804747	50	NFCDD table
Ince Blundell Pumping Station.	SD3289904530	50	NFCDD table
Ince P/Station	SD3286304566	50	NFCDD table
Suttons Bridge to Cheshire Line Path	SD3113307814	50	NFCDD table
Rail Bridge (Altcar Road) to Suttons Bridge	SD3127006782	50	NFCDD table
Abraham's Bridge to Rail Bridge (Altcar	SD3080005735	50	NFCDD table

Road)				
Red Rose Pub to Altmouth P/S	SD2955204304		50	NFCDD table
Altmouth Pumping Station	SD2953004398		200	NFCDD table
Range Cottages to road Red Rose Pub	SD2960104223		50	NFCDD table
Floodgate Road to Altmouth P/S	SD2960804338		50	NFCDD table
Start of Altcar Rifle Range to Oppsit Range Exit Barrier.	SD2959603814		50	NFCDD table
Bailey Bridge to opposit Range Cottages	SD2965404129		50	NFCDD table
Bailey bridge to Floodgates Road.	SD2971104164		50	NFCDD table
Oppsit Exit Barrier To Bailey Bridge	SD2962303959		50	NFCDD table
Exit Barrier to short of Kays Cut Outfall.	SD2968603948		50	NFCDD table
Short of kays Cut Outfall to Bailey Bridge	SD2972104050		50	NFCDD table
Between the dunes within the Altcar Rifle Camp.	SD2893204789		200	NFCDD table
dissmantled railway bridge to Dunnings Bridge Lane (A59)	SD3712600538		50	NFCDD table
At rear of farmhouse at Gorsehill Farm	SD3331613711		50	NFCDD table
Old embankment that joins new bank to watercourse 3 dissused outfall.	SD3729520878		75	NFCDD table
Watercourse 3 dissused outfall to Georges Lane access ramp.	SD3718121102		75	NFCDD table
Fiddler's Ferry (large stone) to old embankment that joins new bank.	SD3771620721		75	NFCDD table
The Wash	SD3783218931		50	NFCDD table
Start of embankment to bend at start of the wash embankment.	SD3762719272		50	NFCDD table
Wash to Moss Lane	SD3767718067		50	NFCDD table
Ainsdale National Nature reserve	SD2768709330	N/A		NFCDD table
Ainsdale NNR - Northern Section	SD2827410598	N/A		NFCDD table
Ainsdale Local Nature Reserve south of Ainsdale Discovery Centre	SD2852210987	N/A		NFCDD table
South Of Blundellsands Sailing Club	SD2952902471	N/A		NFCDD table
Alt Training Bank to North of Far Moss Outfall	SD2960401579	N/A		NFCDD table
Coastguard Station to Alt Training Bank	SD2984100653	N/A		NFCDD table
Blundellsands sailing club	SD2963202849	N/A		NFCDD table
Hall Road West	SD2984100548		20	NFCDD table
Serpentine to Hall Rd West	SD2993800255		20	NFCDD table
Serpentine to Hall Rd West (1)	SJ3016899686		20	NFCDD table
Mariners Road - Serpentine	SJ3060098880		20	NFCDD table
Cabin Hill NNR	SD2820904697	N/A		NFCDD table
Altcar Rifle Range	SD2959303579	N/A		NFCDD table
South of mouth of Alt	SD2965002950	N/A		NFCDD table
Cabin Hill boundary to Formby Point	SD2795404924	N/A		NFCDD table
Formby Point to Formby Golf Club	SD2701106974	N/A		NFCDD table
Formby Golf Club	SD2752008969	N/A		NFCDD table
Formby Golf Club	SD2761209175	N/A		NFCDD table
Marshside Road to Millars Pace	SD3540020657	N/A		NFCDD table
Millars Pace to Bank End, Marshside, Sefton	SD3617321141		20	NFCDD table
Marine Parade to Fairway	SD3321418108		20	NFCDD table
Fairway to Hesketh Road	SD3408518942		20	NFCDD table
Hesketh Road to Marshside Road	SD3450019400		20	NFCDD table
Marshside	SD3522620458	N/A		NFCDD table
weld road-victoria park south	SD3212016455		20	NFCDD table
Birkdale HIlls	SD2994613282	N/A		NFCDD table

south of weld road	SD3136515682	N/A	NFCDD table
Southport Holiday Village	SD2963412677	N/A	NFCDD table
North of shore road, ainsdale	SD2978712924	N/A	NFCDD table
Weld Road to Esplanade	SD3218316740	20	NFCDD table
Pleasureland / Marine Parade	SD3242117207	20	NFCDD table

ATKINS

Knowsley Council
Sefton Council

Strategic Flood Risk Assessment

Executive Summary

June 2009

Sefton Council

Knowsley Council

Page left blank intentionally

Knowsley Council and Sefton Council

Strategic Flood Risk Assessment Executive Summary

5074164/DG/003

Notice

This report was produced by Atkins for the Knowsley Council and Sefton Council for the specific purpose of the Strategic Flood Risk Assessment.

This report may not be used by any person other than Knowsley Council and Sefton Council without the express written permission of ATKINS. In any event, Atkins accepts no liability for any costs, liabilities or losses arising as a result of the use of or reliance upon the contents of this report by any person other than Knowsley Council and Sefton Council.

Atkins Limited

Document History

JOB NUMBER: 5074164			DOCUMENT REF: 5074164/DG/003			
F3	Final	OT	SF	OT	MJ	22/06/09
F2	Final with alterations	NM	SF	OT	MJ	01/06/09
F1	Final	NM	SF	OT	MJ	21/05/09
D1	Draft	SF	MH	MH	OT	31/03/09
Revision	Purpose Description	Originated	Checked	Reviewed	Authorised	Date

Page left blank intentionally

Contents

Section Page

List of Tables

Page left blank intentionally

1. Executive Summary

1.1 Introduction

Background

The Boroughs of Knowsley and Sefton lie within three separate catchments; the River Mersey, the River Alt and the Crossens catchment. Of these, Knowsley lies within the Mersey and Alt catchments and Sefton within all three.

Fluvial flooding has been seen within the Boroughs but has been limited in extent and few historical records are available for these events. Since the installation of the two large pumping stations and tidal controls at Altmouth (1971) and Crossens (1961) no significant fluvial or tidal flooding has been observed, although in Southport (1977) a combination of severe storms and high tides resulted in water levels overtopping the defences. Localised surface water flooding occurs more frequently and at widespread locations throughout both Boroughs. The Leeds and Liverpool Canal also passes through Sefton Borough and there has been flooding of properties in the past (1994) when the canal broke through into the Maghull Brook culvert.

Raised, fluvial flood defences do exist within the two boroughs but typically provide a standard of protection below the current national standard for fluvial defences of a 1% Annual Exceedance Probability (AEP) (1 in 100 year event). Some of the tidal defences in Sefton provide a standard of protection of only 5% AEP (1 in 20 year event) compared to the national standard for tidal defences of a 0.5% AEP (1 in 200 year event).

This Strategic Flood Risk Assessment (SFRA) has been produced to support the Core Strategy and subsequent Local Development Documents, in particular, to demonstrate that a suitable assessment of flood risk within the Boroughs has been undertaken and to provide a robust evidence base, represented by the SFRA document itself. The Councils are currently at an early stage of Local Development Framework (LDF) production and have not yet identified specific land allocations. As the Councils advance through the LDF process the SFRA will inform this decision-making process.

Why Carry out a Strategic Flood Risk Assessment?

Flooding is the most widespread and frequently occurring natural hazard which causes disruption and damage to property, associated economic costs, and can lead to risk of injury and loss of life. It is essential, therefore, that flood risk is considered at all stages of the planning process. Spatial planning should be used to steer developments away from areas of flood risk, and, to ensure that the impacts of development do not exacerbate existing flood risk elsewhere.

Planning Policy Statement 25 (PPS25): Development and Flood Risk has been produced to support the planning decision process with respect to flood risk. PPS25 provides clear advice that Local Planning Authorities (LPAs) should identify areas of different flood risk frequency and steer developments to areas of low flood risk frequency. Specifically, PPS25 advocates steering higher vulnerability land uses, such as residential care homes and housing, to areas of least flood risk. Where this is not feasible and development within areas of some flood risk is required, PPS25 requires the LPA to demonstrate that, for wider sustainability reasons, the site allocated is the most appropriate for development and that suitable mitigation measures are proposed which will limit the risk to people and property.

The Strategic Flood Risk Assessment (SFRA) provides an evidence base to support the first phases of this process and should be used by the Councils (as Local Planning Authorities or LPAs) to inform future planning decision making.

The Knowsley and Sefton Strategic Flood Risk Assessment (SFRA) has been undertaken in accordance with PPS25 to meet the following key objectives:

- *Provide sufficient data and information to enable the LPAs to apply the Sequential Test to land use allocations and, where necessary, the Exception Test;*

- *Enable the LPAs to prepare appropriate policies for the management of flood risk within the Local Development Documents (LDDs);*
- *Inform the Sustainability Appraisals so that flood risk is taken into account when considering options and preparing strategic land use policies;*
- *Identify the need for site specific FRAs in particular locations along with the level of detail required in these areas; and*
- *Enable LPAs to determine the acceptability of flood risk in relation to emergency planning capability.*

The Sequential Test

PPS25 Paragraph D5 states that:

> *The overall aim of decision-makers should be to steer new development to Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, decision-makers identifying broad locations for development and infrastructure, allocating land in spatial plans or determining applications for development at any particular location should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should decision-makers consider the suitability of sites in Flood Zone 3, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.*

The Sequential Test should be applied throughout an entire planning authority district to ensure that all available sites are considered with reference to flood risk, so that alternative sites are easily identifiable should proposed land uses be deemed inappropriate.

A Sequential Test approach has been undertaken using the proposed land allocations as identified by both Knowsley and Sefton Councils within their adopted Unitary Development Plan(s). Information available included proposed land uses and the boundary extents of these sites, some details of intended uses have been provided. The analysis of the sequential testing on specific sites is provided in Appendix C of the SFRA. Furthermore, where required, sites which may require Exception Testing have been identified.

The results of the Sequential Test detailed within this SFRA document provide the information required to ensure that the land uses adopted for development sites within Knowsley and Sefton are appropriate to the level of flood risk at those sites.

The Exception Test

PPS25 recognises that planning local authorities may not be able to locate all future development outside areas at risk of flooding whilst meeting growth demand and providing wider, sustainable development. Many towns within England have grown adjacent to rivers and consequent flood risk. Therefore restricting development to areas outside of these areas may limit the growth potential of urban areas. For example, limiting the development of housing to areas outside of Flood Zone 3a may seriously reduce the ability for planning authorities to meet urban housing targets.

It is for this reason that PPS25 introduces the Exception Test. If an authority can demonstrate, by way of the Sequential Test, that there are no reasonable available sites for development at a lower probability of flooding suitable for the intended use and type then the Exception Test can be applied.

PPS25 paragraph D9 states that for the Exception Test to be passed;

1. *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared. If the DPD has reached the 'submission' stage – see Figure 4 of PPS12: Local Development Frameworks – the benefits of the development should contribute to the Core Strategy's Sustainability Appraisal;*
2. *the development should be on developable previously-developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously-developed land; and*

3. *a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

1.2 Outcomes of the SFRA

1.2.1 Overview

The Boroughs of Knowsley and Sefton have been delineated into areas of low, medium and high probability of fluvial and tidal flooding, based upon existing available information provided by the Environment Agency. The Environment Agency Flood Maps (June 2008) have been adopted as the basis for the SFRA for all watercourses, while detailed flood risk mapping produced as part of the Alt Crossens Catchment Flood Management Plan (CFMP) is used to represent Functional Floodplain. These are mapped in the SFRA.

Zone 3b (Functional Floodplain)

Functional Floodplain is defined as an area used for either flood storage or flood conveyance during periods of flood, and typically, represented by the 5% Annual Exceedance Probability event (1 in 20 year event) in any year or an area designed to flood in an extreme event such as a 0.1% probability event. Greater constraints are placed upon development within Flood Zone 3b 'Functional Floodplain' when compared to any other Flood Zone.

For the purpose of this SFRA, where available, the 4% Annual Exceedance Probability (1 in 25 year event) produced as part of the Alt Crossens CFMP has been used to represent the Functional Floodplain. In areas not covered by the CFMP data, and light of the absence of historical data, the Functional Floodplain has been assumed to be equivalent to Flood Zone 3a.

Zone 3a High Probability

Flood Zone 3 is defined as 'High Probability' with an annual probability of flooding of 1.0% or greater (1 in 100 year event or greater) in any year for fluvial and 0.5% or greater (1 in 200 year event or greater) in any year for tidal or coastal. Flood Zone 3a forms part of Flood Zone 3 which includes the Functional Floodplain.

'Highly Vulnerable' uses (as defined by PPS25, and which include police, ambulance and fire stations) are not considered appropriate for these areas and, where possible, development of 'More Vulnerable' uses (as defined by PPS25, and which include hospitals, and dwelling houses) in these areas should be avoided. However, it is recognised that there may be wider sustainability benefits of developing 'More Vulnerable' land uses within these areas and the method by which the Councils can demonstrate this is by application, and passing, of an Exception Test.

The SFRA provides guidance on the specific development control conditions imposed within Flood Zone 3a. To meet planning requirements, the developer must carry out a detailed site specific Flood Risk Assessment (FRA) to identify constraints to development and measures to mitigate risk to people and property.

Zone 2 Medium Probability

Flood Zone 2 is defined as 'Medium Probability' with an annual probability of flooding between 0.1% and 1.0% (between 1 in 1000 and 1 in 100 year events) in any year for fluvial and 0.1% and 0.5% (between 1 in 1000 yr and 1 in 200 year event) in any year for tidal and coastal flooding. Development of essential community services and utilities, including emergency services and utility infrastructure, should be avoided in these areas. Developers should undertake a site specific Flood Risk Assessment for sites with a medium probability of flooding.

Zone 1 Low Probability

Flood Zone 1 is defined as 'Low Probability' of flooding and incorporates areas where the annual probability of flooding is lower than 0.1% (1 in 1000 year event) in any year. Flood Zone 1 contains all areas of Knowsley and Sefton Boroughs which are not located within Zone 3b, 3a or 2.

A site specific FRA is required for all developments over 1ha in areas within Flood Zone 1.

There are no restrictions on the type of development appropriate within these areas of the two Boroughs with reference to flood risk, however, it is important to note that uncontrolled development within these areas may increase downstream flood risk and therefore developers will need to carry out a Drainage Impact Assessment on these sites to demonstrate that proposed drainage infrastructure designs will mitigate the potential increases of site run-off as a result of development.

Climate Change Allowance

The SFRA considers existing flood risk rather than the potential, future impacts to flood risk of climate change. However, as a result of climate change, it is widely expected that winter floods will happen more often and that rainfall events will be of higher intensities, and this should be considered as part of the planning process with regards to sustainability. It is likely that in Knowsley and Sefton, as elsewhere nationally, increased storminess and rainfall intensities will lead to increased flooding from surface water systems. With regard to fluvial flood risk, DEFRA guidance recommends assuming a 10% increase in fluvial flow up to 2025 and then an increase of 20% thereafter. In the absence of bespoke modelling data, it was agreed that the Environment Agency Flood Map 2 outline could be used to represent the fluvial and tidal climate change up to 2050. The potential increase in fluvial flow rates through Knowsley and Sefton would result in additional properties falling within the 1% AEP outline (100 year event), including commercial, residential and industrial property.

For the tidal climate change scenario, the recommended allowances for net sea level rise on the northwest coastline were considered. Climate change could affect the rate of erosion and deposition along the coastline, as well as increasing the current risks of overtopping.

Combined Risk Map

In an effort to assist the Councils in their understanding of flood risk in their areas, a Combined Risk Map has also been produced, which provides indicative zoning of combined flood risk to the Boroughs. Flood risk associated with surface water and groundwater is reliant upon the records provided by the Environment Agency, the two Councils and United Utilities, and has been mapped on this basis. The Combined Risk Map is not intended for use in sequential testing, but provides an initial reference tool for determining the broad scale risks potentially affecting specific sites.

Other Flood Risk

Whilst there also remains a risk from canal failures, such breaches are rare and, therefore, of relatively low significance. The identification of areas at risk is a complex and site specific assessment, therefore the zoning and delineation of this risk was beyond the scope of this strategic assessment. However, future updates of the SFRA should incorporate information from British Waterways, noting particularly the areas where the canal is elevated above natural ground level or where significant distance between locks reduces the ability to control the flow through a breach.

1.2.2 Sequential Test Outcomes for Knowsley Borough

Knowsley Borough Council identified a total of 59 sites within the Borough. Of these, 51 sites are located within the Low Probability Flood Zone and, therefore, not subject to development restrictions imposed on intended land use.

Of the remaining 8 sites, 2 are located in Flood Zone 2 (Tower Hill action area and Mersey Route 1 Gilmoss – Kiby transport route) and 6 are located within the High Probability Flood Zone 3a (4 economic development sites in Huyton Business Park, a housing development on the former Bridgefield Forum site in Halewood and North Huyton action area). In Flood Zone 2 the development of essential community services and utilities should be avoided and a site specific Flood Risk Assessment should be undertaken. In the Flood Zone 3a areas only the Water Compatible and Low Vulnerability uses are suitable for development without further restrictions, Highly Vulnerable land uses are not appropriate at these locations and an Exception Test is required for Essential Infrastructure and More Vulnerable uses. The 4 sites at Huyton Business Park may potentially be included within the Functional Floodplain and should be reviewed once this information becomes available. If so, PPS25 would classify these sites as inappropriate for use.

Table 1 below provides a summary of the sites assessed within the Borough of Knowsley.

Type of Allocation	Total Sites	Flood Zone 1 Low Probability	Flood Zone 2 Medium Probability	Flood Zone 3a High Probability	Potential Flood Zone 3b Functional Floodplain
Housing Development	8	7	-	1	-
Action Areas and Development Opportunity Sites	7	5	1	1	-
Economic Development	36	32	-	4	4
Transport	8	7	1		-

Table 1: Summary of Sites Assessed within Knowsley

1.2.3 Sequential Test Outcomes for Sefton Borough

Sefton Borough Council identified 84 sites within the Borough for inclusion within the SFRA. Of these 84 sites, 76 sites are located wholly within the Low Probability Flood Zone 1 and therefore are not subject to restrictions on intended land use in terms of PPS25.

1 (Altcar Rifle Range) site is located with the Medium Probability Flood Zone 2 and therefore suitable for all developments except Highly Vulnerable land uses for which an Exception Test would be required.

5 sites are located, at least in part, within the High Probability Flood Zone 3a and in these areas Water Compatible and Less Vulnerable uses (which, according to PPS25, include shops, offices, general industry and storage and distribution) are suitable for development without further restrictions. 2 of these are industrial sites, at Sefton Lane industrial estate (Maghull) and Crossens Way (Southport). Another is the South Eastern Park and Ride site at Kew, Southport. Highly Vulnerable land uses are not appropriate at these locations and an Exception Test is required for Essential Infrastructure and More Vulnerable uses (which, according to PPS25, include hospitals and dwelling houses). 1 of the 5 sites is Town Lane housing site and the other is Ashworth Hospital.

2 sites (the Powerhouse site and land at Formby Business Park) fall at least in part within the Functional Floodplain (Flood Zone 3b) and are therefore restricted to the development of Water Compatible uses or Essential Infrastructure upon passing the Exception Test. The extent to which other uses would be acceptable depends in part on the amount of each site within Flood Zone 3b and the extent of previously development land.

Table 2 below provides a summary of sites assessed within Sefton.

Type of Allocation	Total Sites	Flood Zone 1 Low Probability	Flood Zone 2 Medium Probability	Flood Zone 3a High Probability	Flood Zone 3b Functional Floodplain
Transport Allocations	14	13	0	1	0
Industrial Sites	16	13	0	2	1
Housing Sites	10	9	0	1	0
Employment sites	5	5	0	0	0
Retail Sites	2	2	0	0	0
Development Brief	30	30	0	0	0
Other sites	7	4	1	1	1

Table 2: Summary of Development Sites Assessed within Sefton

1.3 Conclusions & Recommendations

A relatively small area of the two Boroughs is identified to be at risk of flooding and is confined to a small number of river corridors and parts of the Sefton coastline. The main source, and potentially largest impact, is associated with fluvial flooding. Surface water flooding is the secondary source of flood risk, based on a significant number of reported surface water flooding incidents according to information collected from both Councils and United Utilities.In some areas there is potential for flooding from groundwater, tidal flooding or canal breach.

The possible effects of climate change will influence the fluvial flood regime through Knowsley and Sefton in the main watercourses and lead to increased flow into the surface water drainage networks. Climate change could also affect the rate of erosion and deposition along the coastline of Sefton, as well as increase the risks of overtopping defences.

The site-based assessment has indicated that the majority of proposed development sites require no further action, however a number of sites require site specific FRAs, either because of their size or Flood Zone location.

The Way Forward

The SFRA should be used to inform planning policy and development control decision making, and choice of sites within the Core Strategy and Allocations Development Plan of each Borough.

Where possible, in line with PPS25, development should be steered away from areas of flood risk, specifically away from the high probability flood risk areas. Highly Vulnerable land uses should be located within the low probability areas of the Boroughs.

In the circumstance of a development proposal not meeting the requirements of the Sequential Test, the Council and the developer will need to consider the wider sustainability considerations of the development and demonstrate these through the Exception Test, if appropriate. It is important to recognise that all development has the potential to increase the probability of flooding elsewhere without the provision of suitable flood risk mitigation at source, and so site FRAs and development schemes should reduce, mitigate and manage flood risk, including surface water run-off, as much as possible. This will contribute to the sustainability of development with respect to flood risk management within the two Boroughs.

All sites located within Flood Zones 2 or 3 or that are over 1ha in size will require a FRA during the planning process and, where required, the Exception Test should be undertaken as part of this work.

Routine maintenance of watercourses and the condition assessments of bridges and engineered channel sections should be continued on a regular basis, and increased in frequency in areas of known flooding. This will help to reduce and manage flood risk.

Both Councils should review and update their emergency flood risk response plans as a result of the findings and recommendations of the SFRA, in particular the evacuation transport links used to evacuate Sefton Borough, which have been identified at risk from flooding and may become impassable at times.

A Living Document

The Knowsley and Sefton SFRA has been developed in accordance with PPS25, and has been produced based upon published and other information made available at the time of the assessment. It represents a ‘snap shot’ of our understanding of flood risk, with the Flood Zones 2 and 3a based upon the Environment Agency Flood Maps, which are regularly reviewed and updated on a quarterly basis.

It is recommended that this SFRA is revised regularly to incorporate new national and regional policy, new informationand understanding of flood risk as and when detailed flood risk mapping, and other studies such as the Formby Drainage Study, are completed.

Page left blank intentionally

info@atkinsglobal.com
www.atkinsglobal.com