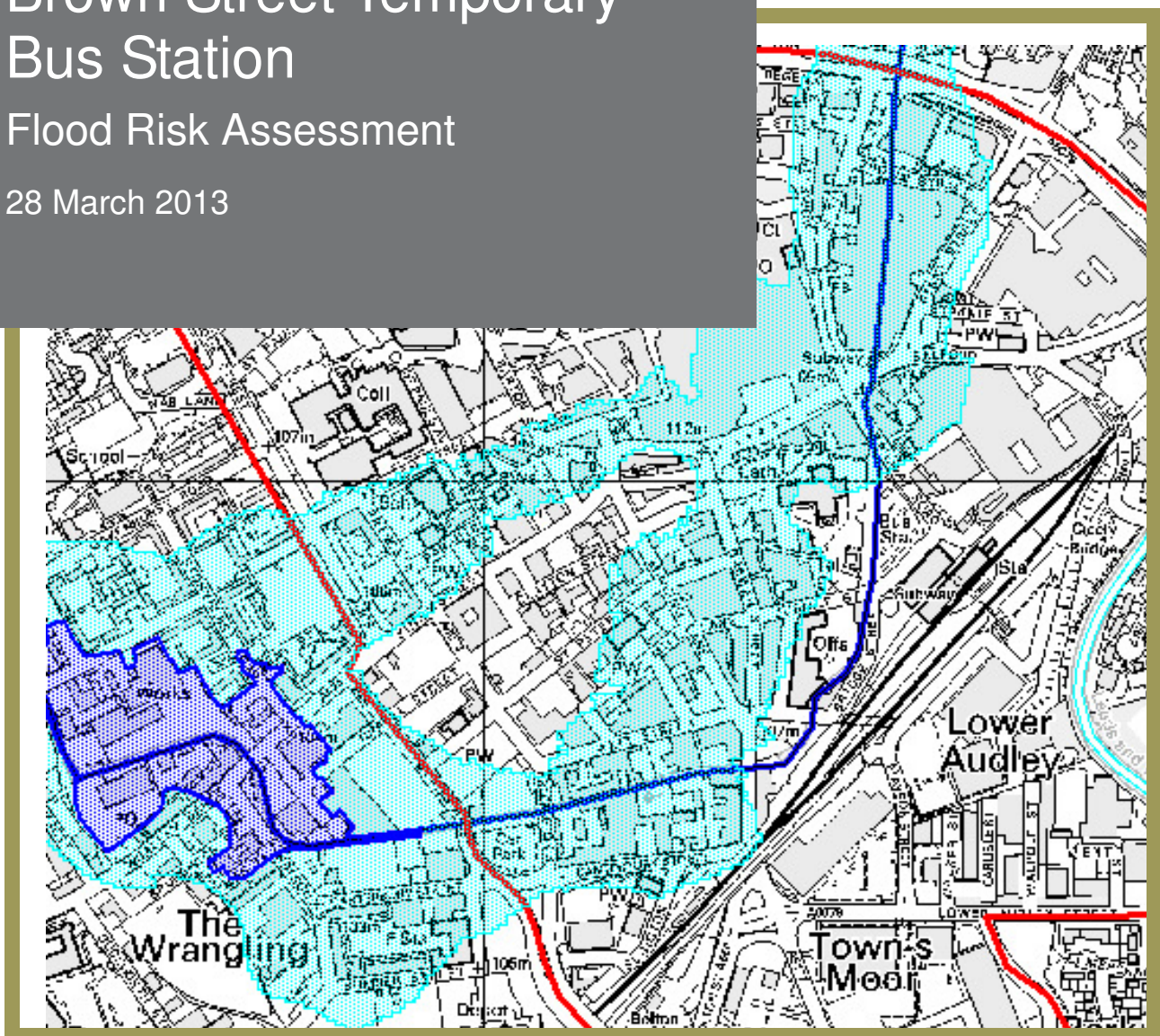


Planning, Environment & Design

Brown Street Temporary Bus Station

Flood Risk Assessment

28 March 2013



Quality Management

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1. Introduction

1.1 Details of Commission

- 1.1.1 Capita Symonds has been appointed by Blackburn with Darwen Borough Council (BwDBC) to undertake a Flood Risk Assessment to accompany the planning application for the redevelopment of a portion of the existing market site in Blackburn. The proposed development is for a temporary bus station, to operate during the construction of a permanent facility. The permanent facility is to be constructed at the southern end of the existing market. Both developments can be classed as 'Essential Infrastructure' within the National Planning Policy Framework. The location of the development is shown in Appendix A.
- 1.1.2 The site lies to the south of Brown Street and to the west of Penny Street. Market Avenue borders the site to the south. The River Blakewater is the nearest main watercourse and this is culverted beneath the Marketplace site between Brookhouse Lane and Bridge Street. A Flood Risk Assessment is needed to support the planning application as the development lies within Flood Zone 2 (0.1% annual probability or 1 in 1000 year) according to the Environment Agency Flood Zone maps. The purpose of this document is to provide an assessment of the risk of flooding to the site which can then be used to inform the re-development proposals. The proposed development will result in an increase in housing density on the site. This Flood Risk Assessment outlines the following:-
- i) The existing flood risk to the site from the River Blakewater, surface water runoff, artificial sources and groundwater; and
 - ii) the consequences of flooding to and from the proposed development proposal and advising on the how this will be managed, if necessary.
- 1.1.3 An assessment of areas potentially at risk from flooding has been undertaken and any (at risk) area has been examined in relation to its potential to increase flood risk both on and off site. This report is for the use of BwDBC only and should not be relied upon by other parties unless specifically advised in writing by Capita Symonds Ltd.
- 1.1.4 This report describes the outcome of the assessment into flood risk issues and considers the site proposal in accordance with guidance outlined in the National Planning Policy Framework. The FRA will assess the risk of flooding at the site, show how flood risk at the redeveloped site will be managed and will demonstrate that the site will not contribute to an increased flood risk to the surrounding areas.
- 1.1.5 The Environment Agency was consulted for advice regarding the Flood Risk Assessment for the site, including an initial drainage design proposal. The response indicates that there are no issues with the proposals for the temporary site drainage.

- 1.1.6 An assessment of areas potentially at risk from flooding has been undertaken and any (at risk) area has been examined in relation to its potential to increase flood risk both on and off site.

2. Policy Appraisal

2.1.1 The following section discusses the relevant planning policies which may influence the development of the Blackburn Bus Station site.

2.2 Flood and Water Management Act, 2010

2.2.1 Combined with the Flood Risk Regulations 2009, (which enact the EU Floods Directive in the England and Wales) the Act places significantly greater responsibility on Local Authorities to manage and lead on local flooding issues. The Act and The Regulations together raise the requirements and targets Local Authorities need to meet, including:

- Playing an active role leading Flood Risk Management;
- Development of Local Flood Risk Management Strategies (LFRMS);
- Preparation of preliminary flood risk assessments and flood risk management plans;
- Development and implementation of drainage and flooding management strategies; and
- Responsibility for first approval, then adopting, management and maintenance of Sustainable Urban Drainage System (SUDS) where they service more than one property.

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

- i) Sustainable drainage (SUDs) - the Act makes provision for a national standard to be prepared on SUDS, and developers will be required to obtain local authority approval for SUDS in accordance with the standards, likely with conditions. Supporting this, the Act requires local authorities to adopt and maintain SUDS, removing any ongoing responsibility for developers to maintain SUDS if they are designed and constructed robustly.
- ii) Flood risk management structures - the Act enables the Environment Agency and local authorities to designate structures such as flood defences or embankments owned by third parties for protection if they affect flooding or coastal erosion. A developer or landowner will not be able to alter, remove or replace a designated structure or feature without first obtaining consent.
- iii) Permitted flooding of third party land - The Environment Agency and local authorities have the power to carry out work which may cause flooding to third party land where the works are deemed to be in the interest of nature conservation, the preservation of cultural heritage or people's enjoyment of the environment or of cultural heritage.

2.3 National Planning Policy Framework (NPPF) March 2012

2.3.1 In determining an approach for the assessment of flood risk for the proposal there is a need to review the policy context. Government Guidance requires that consideration be given to flood risk in the planning process. The National Planning Policy Framework was issued in March 2012 and outlines the national policy on development and flood risk assessment. This replaces with immediate effect Planning Policy Statement 25.

2.3.2 The Framework states that the in appropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

2.3.3 The essence of NPPF is that:

- Local Plans should be supported by Strategic Flood Risk Assessment and develop policies to manage flood risk from all sources, taking advice from the Environment Agency and other relevant flood risk management bodies, such as lead local flood authorities and internal drainage boards.
- Policies in development plans should outline the consideration, which will be given to flood issues, recognising the uncertainties that are inherent in the prediction of flooding and that flood risk is expected to increase as a result of climate change.
- Planning authorities should apply the precautionary principle to the issue of flood risk, using a risk based search sequence to avoid such risk where possible and managing it elsewhere;
- The vulnerability of a proposed land use should be considered when assessing flood risk;
- Use opportunities offered by new developments to reduce the causes and impacts of flooding;
- Planning authorities should recognise the importance of functional floodplains, where water flows or is held at times of flood, and avoid inappropriate development on undeveloped and undefended floodplains;
- The concept of Flood Risk Reduction, particularly in circumstances where development has been sanctioned on the basis of the "Exception Test".

2.4 Technical Guidance to the National Planning Policy Framework March 2012

2.4.1 The Technical Guidance to the National Planning Policy Framework provides additional guidance to local planning authorities to ensure the effective implementation of the planning policy set out in the National Planning Policy Framework on development in areas at risk of flooding. The guidance retains key elements of the now superseded PPS 25.

- The document provides supporting information on:
- The application of the sequential approach and Sequential and Exception Tests;
- Measures to reduce flood risk to acceptable levels;
- How to manage residual risks; and
- Guidance on how to take climate change into account.

2.5 Blackburn with Darwen Stage 1 Strategic Flood Risk Assessment

2.5.1 In December 2008 Blackburn with Darwen Borough Council completed a Strategic Flood Risk Assessment (SFRA). The main purpose of the SFRA is to:-

- Inform the preparation and sustainability appraisal of the Council's Local Development Documents as well as other relevant Council strategies and plans;

- Provide the basis from which to apply the Sequential Test and Exception Test in the development allocation and development control process (see Annex D of PPS25)
- Give guidance on the preparation of site specific Flood Risk Assessment (FRAs)
- Be used by emergency planners to assess and improve emergency plans and infrastructure
- within the borough

The SFRA included an assessment of all sources of flooding based on the available data. Maps provided in the SFRA identify the site to be located within Flood Zone 2.

2.6 Blackburn and Darwin Level 2 Strategic Flood Risk Assessment (Sep 2012)

- 2.6.1 A Level 2 SFRA was completed by Capita Symonds in September 2012 and the findings of this study have been considered within this FRA. The Level 2 SFRA includes a detailed assessment of the flood risk within Blackburn town Centre, which is particularly relevant to this FRA. The SFRA also provides updated Flood Zone mapping information including depth and hazard along with maps of the potential risk of reservoir flooding to the site and surface water flooding as depicted in the Environment Agency Flood Maps for Surface Water. These maps have been included within Appendix A.
- 2.6.2 The Level 2 SFRA also includes guidance for developing within the Blackburn with Darwen Borough Council.

2.7 Lancashire County Council Preliminary Flood Risk Assessment (June 2011)

- 2.7.1 The Preliminary Flood Risk Assessment (PFRA) was prepared for Lancashire County Council primarily to deliver the first step of the Flood Risk Regulations (2009). Based on these outputs it is estimated that approximately 4,001 properties within the Borough are potentially at risk of surface water flooding during a rainfall event with a 1 in 200 annual chance of occurring.

2.8 The SUDS Manual, CIRIA (2007)

- 2.8.1 This guidance provides best practice on planning, design, construction, operation and maintenance of Sustainable Drainage Systems (SUDS) to facilitate their effective implementation within developments.

- 2.8.2 The guidance supersedes previous general guidance on SUDS and addresses landscaping, biodiversity issues, public perception and community integration as well as water quality treatment and sustainable flood risk management. The output is based on results contained in the Environment Agency R&D Report SCO20114/2.
- 2.8.3 The SUDS Manual aims to provide comprehensive advice on the implementation of sustainable drainage techniques in the UK. It provides guidance on:
- Initial planning;
 - Design through to construction;
 - The management of SUDS in the context of the current regulatory framework; and
 - Advice on landscaping, waste management, cost, and community engagement.
- 2.8.4 The SUDS Manual has been used to provide the necessary design guidance for the surface water drainage strategy incorporated into the masterplan.

2.9 Sewers for Adoption 6th Edition (March 2006)

- 2.9.1 This document is the definitive guide for those planning, designing and constructing sewers and pumping stations for subsequent adoption by water companies in England and Wales under Section 104 of the Water Industry Act.
- 2.9.2 This guidance provides best practice on planning, design, construction, operation and maintenance of SUDS to facilitate their effective implementation within developments.

2.10 Local Development Documents

- 2.10.1 Blackburn with Darwen Borough Councils Local Development Framework (LDF) is made up of a suite of documents which relate to land use across the Borough. One of these documents is the Core Strategy Preferred Options Report, October 2007. Section 11, Protecting and Enhancing the Environment within this document highlights an Overall Environmental Strategy for the Core Strategy and subsequent DPDs with the following principles:
- i) An absolute limit on the degree of environmental impact that will be acceptable.
 - ii) A concept of “net environmental impact” created by the Plan. Within this section promote positive actions that benefit the “strategic” environmental issues, notably climate change and flooding.
 - iii) A principle that policy should seek “win-win” situations wherever possible.
 - iv) A principle that new development should mitigate its environmental impacts.¹

¹ Blackburn with Darwen Core Strategy Preferred Options Report – October 2007

- 2.10.2 Providing space for nature is important for people too. Green spaces contribute to local amenity, provide a contrast to the built environment, serve as a buffer between incompatible land uses and often provide a place for informal recreation. Where these areas are linked, then their nature conservation value is enhanced, as green corridors allow for the movement of both plant and animal species. Green Space Corridors have been identified in the Plan with the aim of retaining not only links between open areas but also with the countryside to ensure diversity of wildlife in the urban areas².
- 2.10.3 The proposed bus station is a key component of the regeneration proposed in the LDF for Blackburn with Darwen Borough Council. Improvements to The Boulevard in Blackburn have already created a closer link between the town centre retail core and the newly redeveloped railway interchange.

2.11 Sequential and Exception Test

- 2.11.1 The overall aim of the Sequential Test is to direct 'vulnerable' new development towards the lowest available flood risk area first. Where there are no reasonably available sites in Flood Zone 1, planners should consider reasonably available sites in Flood Zone 2. 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 vulnerability of proposed land uses and applying the Exception Test if required.
- 2.11.2 Table 3 in the NPPF Technical Guidance, indicates that 'essential infrastructure' such as the proposed development is "appropriate" within Flood Zone 2, however, that does not negate the need to consider whether there are appropriate sites for this development that are in a location with a lower risk of flooding.
- 2.11.3 The redevelopment of Blackburn Marketplace forms part of the larger Masterplan for the transformation of Blackburn Town Centre and therefore in addition to the use of this particular location for essential infrastructure the site has several major sustainability advantages over the current use of the site. In particular the chosen location of the site will benefit the integrated transport system of Blackburn and alternative sites are considered likely to be less favourable in this respect.
- 2.11.4 Due to the location of essential infrastructure within Flood Zone 2 (medium risk) the proposed development site is considered to meet the requirements of the Sequential Test and does not need to be tested against the specifications of the Exception Test. The remainder of this FRA shows that the development will be 'safe' and does not increase flood risk elsewhere.

² Blackburn with Darwen Local Plan – April 2002

3. Development Site

3.1 Site Location & Description

- 3.1.1 The Blackburn Bus Station site is located in Blackburn Town Centre. The proposals include a bus apron, bounded by footways, and incorporating 3 pedestrian islands to allow boarding of buses. There will be 12 bus parking bays within the apron, and 3 layover spaces contained within a lay-by which will be created along Brown Street. This area covers approximately 0.82 hectares – refer to Figure 3.1 for a site location plan.
- 3.1.2 The majority of the site will comprise hard-standing either as vehicle access or pedestrian concourse areas; however an area to the south of the site will consist of stone, remaining from the demolition works to the existing market building. Access to the site will be gained from Brown Street to the north with in-line bays for the bus interchange and egress from the site will be to Brown Street to the north west and Ainsworth Street to the south east. Appendix A provides further information on the proposed layout.

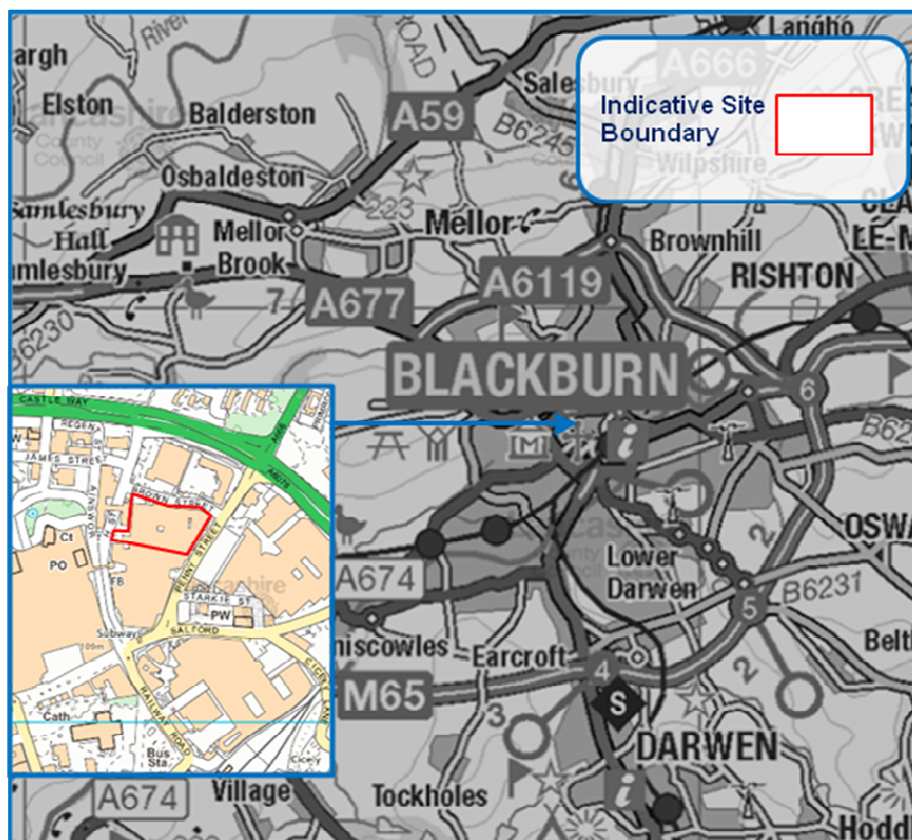


Figure 3.1: Site Location Plan (not to scale)

3.1.3 A significant proportion of the development footprint lies within the current boundary of the Blackburn Markets site. The development will require the demolition of the structures in this area which is currently being considered as a separate exercise. A planning application for the demolition of the market building has been submitted.

3.1.4 There will be a small decrease in impermeable land cover as a consequence of the re-development as the entire site is already hard standing. As there will be a slight increase in the permeability of the site, there will be no change to the volume of peak flow rates of surface water leaving the developed site. The redevelopment of the site has potential for landscaping/ planting areas to be incorporated into the design (to be confirmed) and as a result there may be a minor increase in permeable areas on site.

3.2 Topographic Survey and Site Levels

3.2.1 Spot height levels obtained from the topographic survey provided by the Council (date and surveyor are unknown), indicate that the site is relatively flat, sloping gently from the north to south with levels ranging between 108 – 110 m AOD.

3.2.2 In terms of existing surface water flow paths, any overland flow on the western part of the site would be likely to flow towards the east of the site and away towards the south, following the natural course of the River Blakewater. Ponding on the site is unlikely as the overland flow path of the River Blakewater shows that flow would travel across the site and not pond. As there is no detailed topographic survey available for this assessment it is not known if there are any isolated topographic lows on the site where flows could pond.

3.3 Geology and Soil Type

3.3.1 The site is located on the Soil Survey of England and Wales 1:250,000 Sheet 3, Soils of Northern England. The soil map indicates that the site is classified as Urban and therefore has not been surveyed, however, shallow geology of the surrounding area has been considered as a proxy and this is shown to vary. In the area downstream of the site Glaciofluvial drift geology is present and is overlain by soils described as a “Deep and well drained sandy and coarse loamy soils” however some areas within this category may be slowly permeable and prone to slight seasonal waterlogging. This would be supported by other geology found in the area including sandstone mixed with shales and mudstones which are overlain by soils which are slowly permeable and seasonally waterlogged due to the fine silty and clayey make ups of the soil.

3.3.2 As the site is located in the natural overland flowpath of the River Blakewater. This would suggest that before the River Blakewater was culverted, the site would have been located on/near the river's bank. Alluvium deposits are usually associated with river bed and banks, so it is possible that this is the nature of the soils beneath the existing made-ground of the site. The existing made-ground would however be 3 to 4 meters above where the river bed would have originally been.

- 3.3.3 A more detailed ground assessment would have to be undertaken to establish the soils which the site underlain by. If there is a presence in superficial deposits of glacial sands and gravels this would indicate that soakaways may be appropriate as a method for discharging surface water runoff in the superficial deposits. If soakaways are used, any surface water run-off from paved areas with vehicular access (roads, hard landscaping, and bus bays) is likely to be required to first be passed through an appropriate class of oil/fuel interceptor. Bedrock in the area consists of coal measures.

4. Flood Probability

4.1 Vulnerability Classification

- 4.1.1 The site lies within the Environment Agency's Flood Zone 2, which is described within the NPPF Technical Guidance Table 1 as having a 'Medium Probability' of flooding. Flood Zone 2 is defined as "Land assessed as having between a 1 in 100 and 1 in 1,000 year annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1,000 year annual probability of sea flooding (0.5% - 0.1%) in any year." The Environment Agency's flood zone map is shown in the 'Blackburn Town Centre' site assessment which was undertaken as part of the Level 2 SFRA.
- 4.1.2 With reference to Table 2 of the NPPF, the Flood Risk Vulnerability Classification of the proposed development would be 'Essential Infrastructure. The 'Essential Infrastructure' land use includes buildings used for essential transport infrastructure.
- 4.1.3 NPPF, Table 3 'Flood Risk Vulnerability and Flood Zone Compatibility' is reproduced below. The table illustrates that 'Essential Infrastructure' is compatible with a location in Flood Zone 2.

Flood Risk Vulnerability classification	Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test Required	✓	✓
Zone 3a	Exception Test Required	✓	✗	Exception Test Required	✗
Zone 3b	Exception Test Required	✓	✗	✗	✗

4.2 Sources of Flooding – Actual Flood Risk

- 4.2.1 This section provides a review of flooding from land, sewers, groundwater and artificial sources in addition to rivers and the sea. It considers the site specific assessment for the Black Burn Town Centre that was completed as part of the Level 2 SFRA undertaken on behalf of BwDBC by Capita Symonds.

Fluvial Flood Risk

- 4.2.2 Fluvial flooding occurs when the amount of water within a river channel exceeds the flow capacity of the river channel. Most rivers have a natural floodplain into which the water spills in times of flood. Flows in the River Blakewater are generally expected to be confined within the channel banks. The channel is highly engineered and has historically been contained within high flood walls. Flooding at the location of the proposed bus station is most likely to occur if flows exceed the capacity of the River Blakewater upstream of Brookhouse Lane with the result that flood water flows overland towards the proposed site. This flood mechanism was highlighted by the Blackburn SFRA undertaken by Capita Symonds in 2006 and more recent modelling undertaken on behalf of the Environment Agency by Royal Haskoning (2011).
- 4.2.3 Blackburn with Darwin Borough Council (BwDBC) provided data for this FRA from the detailed hydraulic model study of the River Blakewater, carried out by Capita Symonds in 2006. The study used a 1D/2D TUFLOW model of the River Blakewater and modelled water levels in the river for different return periods. The more recent hydraulic modelling data is not available for use in the timeframe for delivering this FRA, however, the data has been seen and the outlines and mechanisms of flooding simulated are not significantly different.
- 4.2.4 According to the model of the River Blakewater, the maximum predicted flood level on the site for the 0.1% AEP event, when the capacity of the culvert at Brookhouse Lane is exceeded, is approximately 110 m AOD. Flood levels fall from north to south across the site and along the southern boundary where ground levels are approximately 108.2 m AOD; flood levels are approximately 109m AOD. The site location is shown in the Figure 4.1 below that indicates predicted flood depths for the 0.1% AEP event.
- 4.2.5 Upstream of the proposed site is a major culvert on the River Blakewater which is approximately 1km in length. The culvert begins at Brookhouse Lane and carries flows underneath the town centre emerging into open watercourse downstream of Bridge Street, near the railway station. The culvert is sufficiently large to carry flows in a major flood event however the Blackburn SFRA suggests that the capacity is likely to be exceeded during a 0.1% AEP event. By definition therefore, the risk of flooding from this mechanism is 'residual'. Figure 4.1 identifies the Extents of Flood Zone 2 and the predicted flowpaths through the site. An additional 'residual' risk is that from blockage of this culvert in the event of a flood and this is considered further in Section 5.

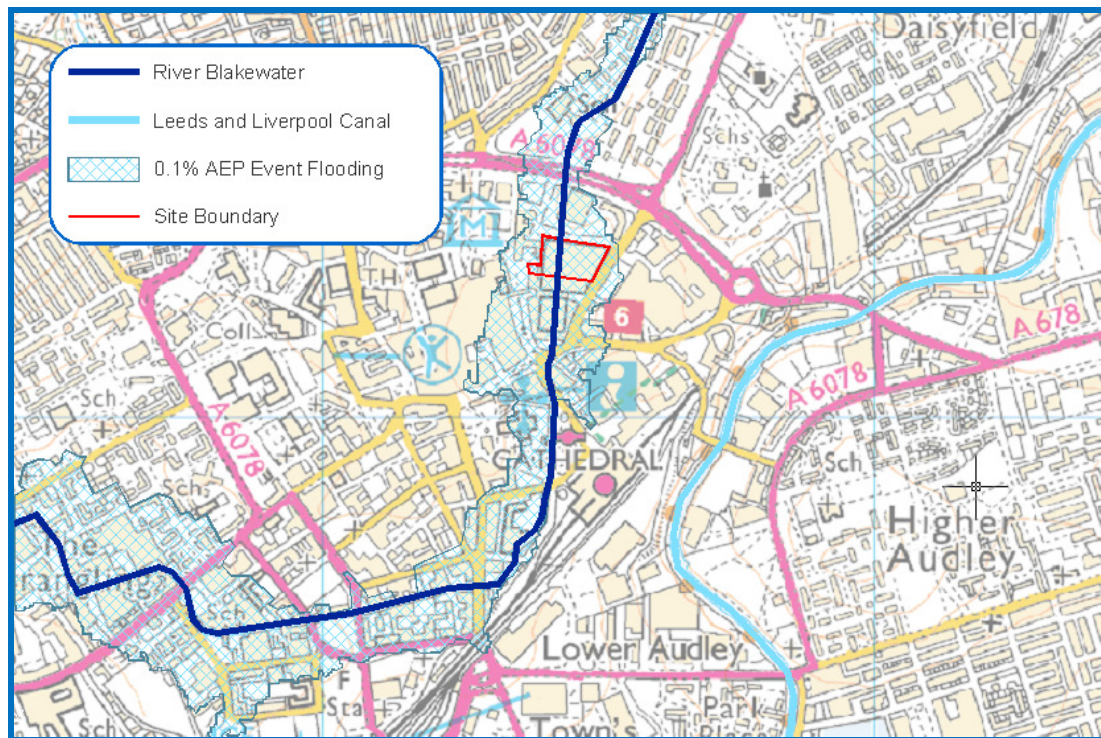


Figure 4.1 – 0.1% AEP Event Flooding

- 4.2.6 The entrance to the culvert is located in excess of 500m to the northeast of the site. If the culvert capacity is exceeded upstream, the site would be inundated to a greater or lesser degree as it lies in the overland flow path that water would follow until it enters the river again further downstream. The extent of inundation would depend upon the overtopping flow rate and volume. The Level 2 SFRA indicates that inundation would be marginal in a 1% AEP plus climate change event and total in the event of a 0.1% AEP event.
- 4.2.7 The most southern part of the site along Salford is located approximately 350m to the north of the edge of the modelled fluvial Flood Zone 3 (high risk). Flood levels within the Flood Zone 3 predicted outline to the south of the site are below 107.15m AOD at the closest point to the site (based on reviewing the Flood Zone 3 outline against the local topographic levels). Site levels are approximately 108.2m AOD along Salford (according to the site topographic survey).

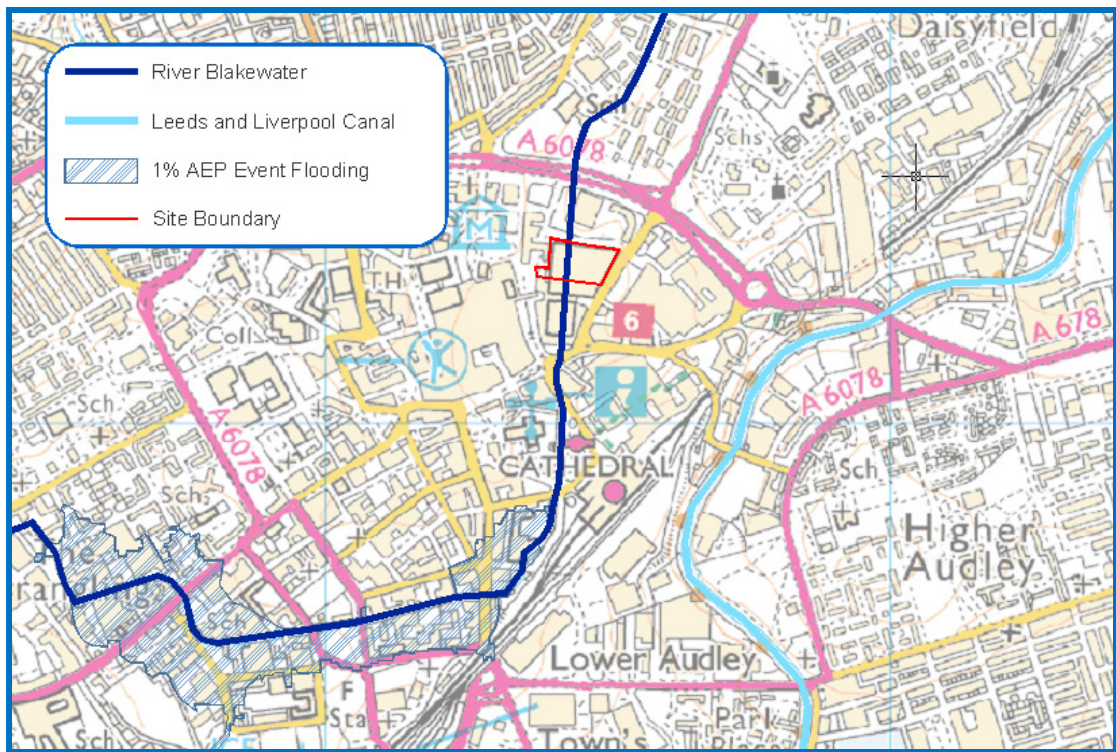


Figure 4.2 – 1% AEP Event Flooding

- 4.2.8 Tidal flooding occurs when a high astronomical tide exceeds the level of coastal land or coastal flood defences. Tidal flooding can also be caused a result of ‘tide locking’ rivers or estuaries. Tide locking prevents a river from discharging into the sea, causing ‘backing up’ and resulting in tidal/fluvial flooding. Tidal and tidal/fluvial flooding is not a mechanism which occurs in the site area.

Flood Risk from Land, Surface Water and Sewers

- 4.2.9 Intense rainfall that is unable to soak into the ground or enter drainage systems can result in localised flooding. The majority of the area surrounding the site is urbanised and rainfall in most cases can be expected to drain through sewer systems rather than through natural infiltration. Where the capacity of the drainage network is exceeded, overland flow may occur.
- 4.2.10 Flooding from sewers occurs when the sewer is overwhelmed by heavy rainfall, becomes blocked or is inadequately designed. Sewers are generally designed to cope with mid to low order rainfall events (i.e. not to flood during events up to 3.3% AEP event/1 in 30 year return period). United Utility asset location plans, presented in Appendix C, show the location and diameter of the sewers at the site and the surrounding area. No direct assessment of the capacity of the system has been done for this FRA. It is recommended that the detailed drainage design for the site consider any constraints imposed on discharging runoff from the site.

- 4.2.11 The Flood Maps for Surface Water, Figure 4.3, identifies that the site is at risk from surface water flooding from a 0.5% AEP event. A review of the outlines indicates that the area affected by surface water flooding can be related to the natural flowpath of the River Blakewater, which is culverted beneath the site.

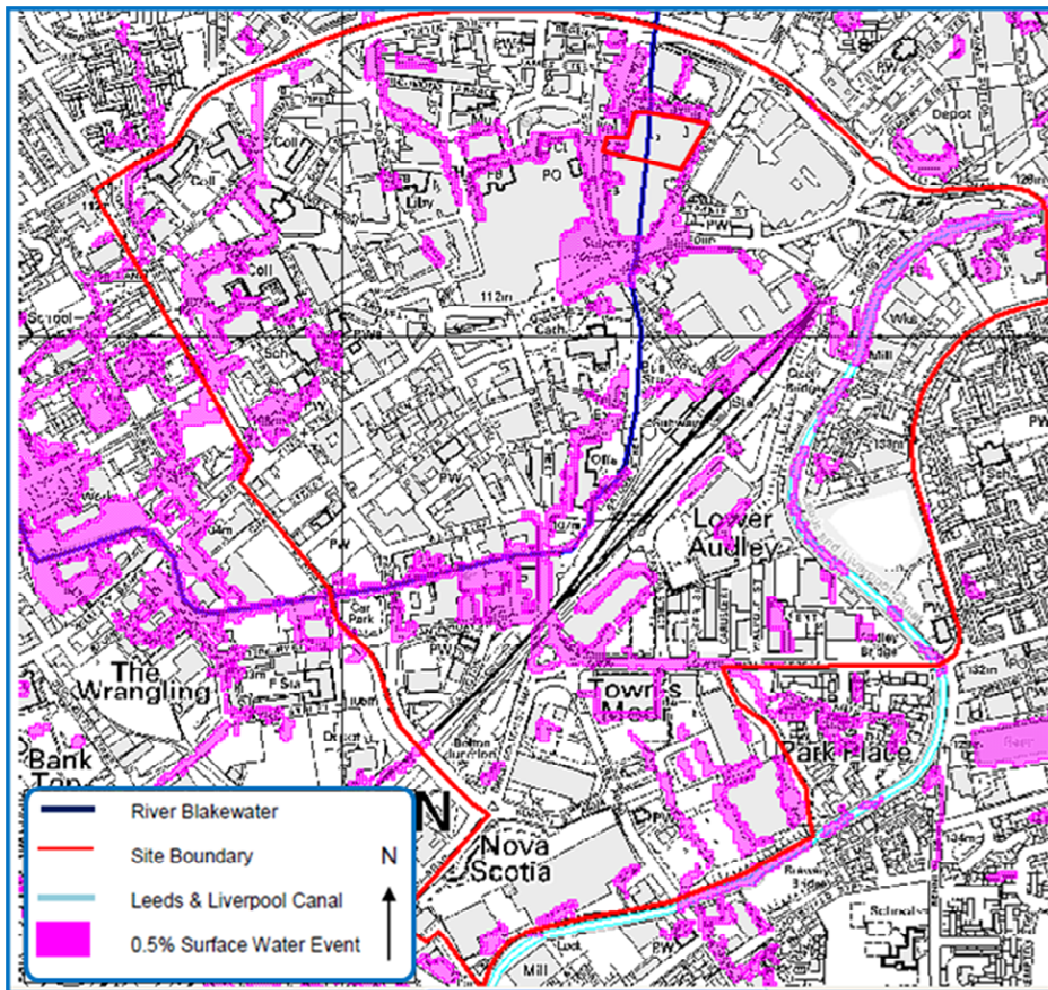


Figure 4.3 – Predicted Surface Water Flooding Areas within Blackburn during a 0.5% AEP event.

- 4.2.12 United Utilities plans (provided within Appendix C) indicate that combined surface water sewers receive runoff from the site and discharge to the culverted River Blakewater. Surface water runoff is identified as a potential source of flooding at the site, though drainage engineers at Blackburn with Darwen Borough Council have confirmed that there is no history of surface water flooding at the site – this is further confirmed within Figure B5-1 of the Level 2 SFRA (refer to Appendix A).

- 4.2.13 The events of summer 2007 however put this into context. The rainfall during Summer 2007 was unprecedented and the severe flooding which followed came after the wettest ever May to July period since national records began in 1766³. Met Office records show that the total cumulative rainfall in May, June and July 2007 averaged 395.1mm across England and Wales – well over double average levels. This resulted in flooding in many areas of the country that had not been previously affected. A lack of history therefore does not suggest that it is not possible. Work by Capita Symonds in areas that were affected suggests that the probability of similar events is between 1% and 0.1% per annum.
- 4.2.14 In the event of the existing combined and surface water sewers surcharging, the local topography suggests that water may pond near the site until such depths occur that allows runoff to be conveyed down Railway Road. However, the manholes that are located on or close to the boundary of the site may discharge on to the site and flow across parts of the site. Flows that may affect the site are likely to be shallow.

Flood Risk from Artificial Sources

- 4.2.15 The site is shown to be at a residual risk of flooding from a reservoir breach, as shown within Figure 4.4. A worst-case breach at the Ramsgreave Reservoir to the north of the site is predicted to affect the area of Brown Street, the Market Hall – depths associated with this flooding are unknown, but based on the extent it is assumed that they would be below 0.5m within the boundary of the development envelope.

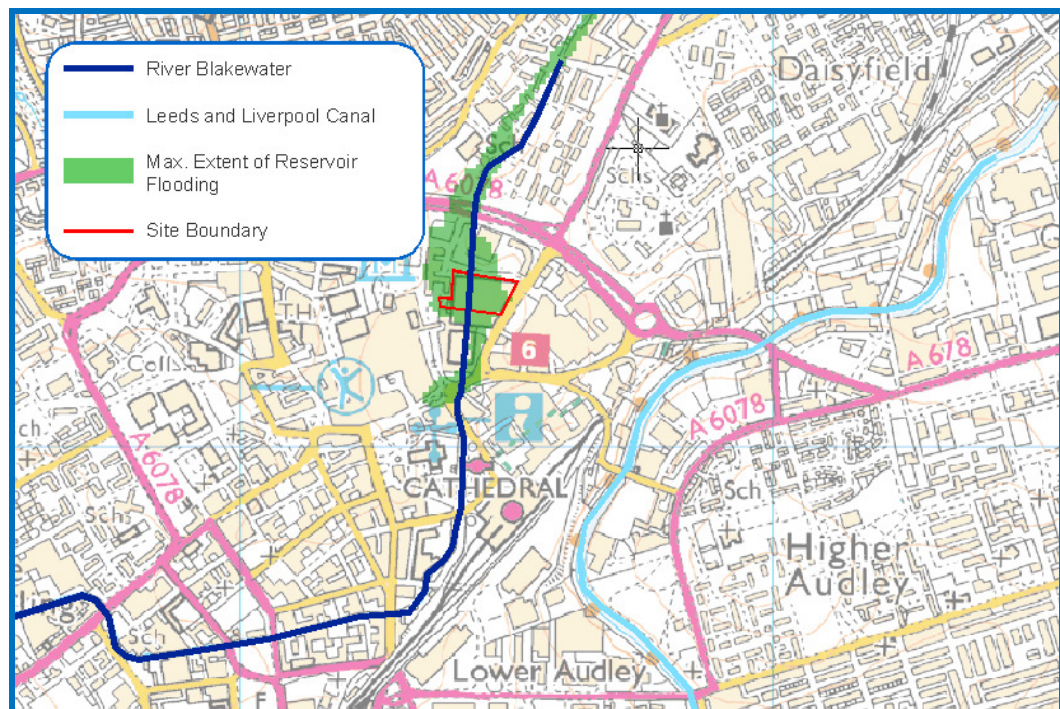


Figure 4.4 – Maximum Extent of Reservoir Flooding

³ The Pitt Review, Learning Lessons from the 2007 floods, An independent review by Sir Michael Pitt, June 2008.

Groundwater Flood Risk

- 4.2.16 Groundwater flooding occurs when water levels in the ground rise above surface elevations. It is most likely to occur in low-lying areas underlain by permeable rocks. As the site is underlain by glacial sands and gravels there is a potential for groundwater to rise above the surface, however the area is not known to have a history of groundwater flooding according to the Environment Agency Further site investigations would be necessary to determine if the water table is perched in this area, however, the risk of groundwater flooding is considered to be not significant to the proposed land use as there are no proposed basement works.
- 4.2.17 The Lancashire Preliminary Flood Risk Assessment indicates that Blackburn is classified as having a low susceptibility to groundwater flooding. The PFRA indicates that whilst the risk of flooding from groundwater is low, it is likely to have some influence on surface water flooding, which will mean that soils will be less able to accept rainfall before becoming saturated and that the ground is less able to be used as soakaways

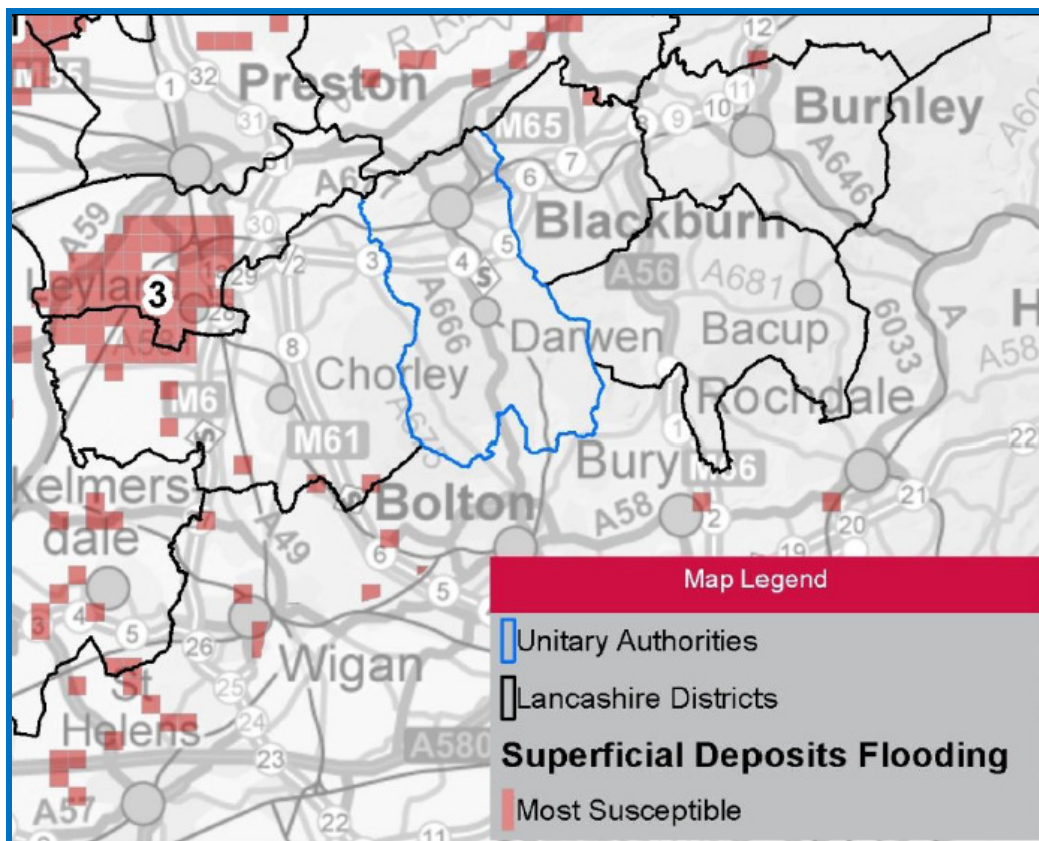


Figure 4.4 – Areas Susceptible to Groundwater Flooding within Blackburn
(Source: Lancashire PFRA, 2011).

5. Flood Risk Management

5.1 Principles of Flood Risk Management

- 5.1.1 NPPF requires a precautionary approach to be undertaken when making land use planning decisions regarding flood risk. This is partly due to the considerable uncertainty surrounding flooding mechanisms and how flooding may respond to climate change. It is also due to the potentially devastating consequences of flooding to the people and property affected.
- 5.1.2 Flood risk is a combination of the probability of flooding and the consequences of flooding. Hence 'managing flood risk' involves managing either, the probability of flooding or the consequences of flooding, or both.
- 5.1.3 NPPF requires flooding from tidal, fluvial, land, surface water & sewerage and from groundwater to be considered. The flood risk management measures discussed in this section are based on the sources of flooding identified in Section 4 that are considered to pose an unacceptable risk to the development proposals.

5.2 Development Layout

- 5.2.1 The proposed redevelopment layout of the Blackburn Bus Station is shown in drawings in Appendix A of this report. The proposed site falls north to south, generally in line with existing falls. In the west –east axis, the site falls inwardly to the centre. Due to the site being located on an existing flow path for flood water during a 0.1% AEP event it is critical that any development on the site does not impede the passage of flow across the site. The dominant direction of flow during this event is from north to south as shown in Figure 4.1 and this is satisfied by retaining the general fall of the site, and the absence of any structures within the site (max kerb upstand is 160mm).
- 5.2.2 The Environment Agency's Development and Flood Risk department has also specified that there must be no development over the culvert (shown in the drawing in Appendix A) or within 8m of either edge, without prior written consent. A review of the proposed development plans indicates that the foundations of the proposed bus stations will be within 7m of the culvert and works to construct the bus parking bays and demolitions works of the existing structures will occur above the culverted Blakewater. The Council must obtain a Flood Defence Consent from the Environment Agency in order to demolish the existing building and construct this bus station and avoid any issues on delivery of the infrastructure. It must be noted that the proposed development will allow easier access (through the access road surface) to the culvert when compared to the current building which is constructed over the structure.

5.3 Access/egress and Flood Warning

- 5.3.1 Safe access from the Bus Station in case of flooding has been considered. As described above, there is some flood risk at the property from overland flow paths created where the capacity of upstream culvert on River Blakewater is exceeded. The Environment Agency has stated that there is no history of flooding on the site however it is recommended that emergency evacuation plans for the site include an escape route to higher ground north along Penny Street to the A677 (Barbara Castle Way) during an extreme flood event. The management team of the Bus Station should also be encouraged to be registered with the alert service provided by the Met Office for severe weather warnings related to heavy and intense rainfall in the Blackburn area. Even though the site is not within the Environment Agency Flood Zone 3 (1% annual probability event) and there is no flood warning service specific to the site, the management of the Bus Station can register for Flood Warnings issued in the area of Blackburn.
- 5.3.2 A detailed access/exit plan should be prepared for the Bus Station, in consultation with the Environment Agency, prior to occupation of the building in order to inform the public and staff of their requirements during a flood event and identify the direction in which to leave the site in order to escape floodwaters.

5.4 Surface water management

- 5.4.1 The impermeable area of the Bus Station is assumed to be the same as the existing impermeable area on site and therefore surface water runoff is not expected to increase from the site as a result of the redevelopment.
- 5.4.2 There is limited scope for the use of SuDS on this redevelopment as the site is relatively constrained, is a temporary facility, and includes no specific area designated as "landscaped". There are no details included in the proposal plans of the surfacing of this landscaped area and therefore for the surface water assessment included in this report, the entire site has been considered as impermeable.
- 5.4.3 Other than local changes to the drainage network to facilitate the construction of this development, it is envisaged that there will be no changes to the management of surface water runoff from the existing situation. Surface water runoff will continue to enter the existing sewer network in the same way and at the same rate as at present and there will be no increase in flood risk from surface water to the site or elsewhere in the catchment.

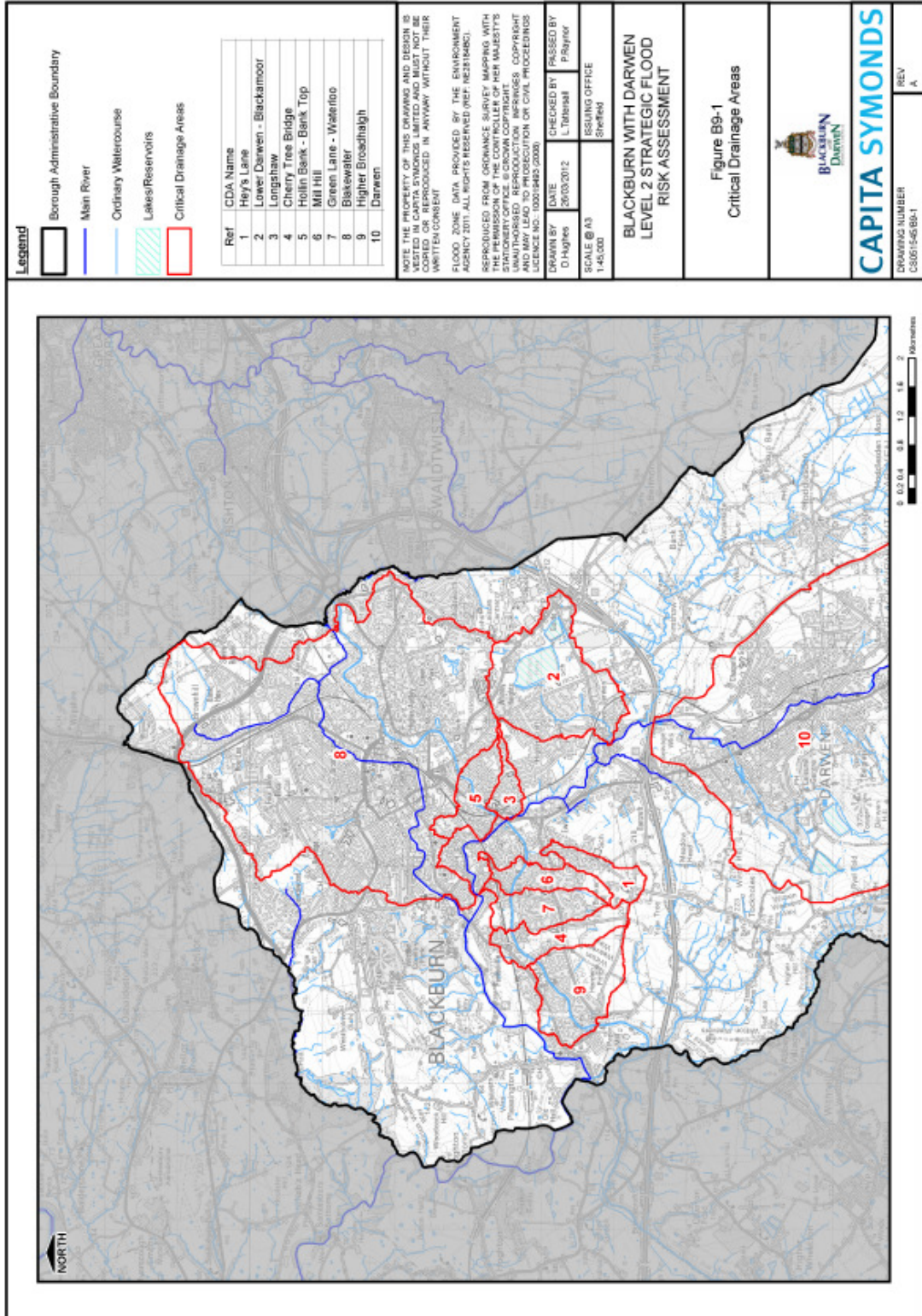
6. Summary and Conclusions

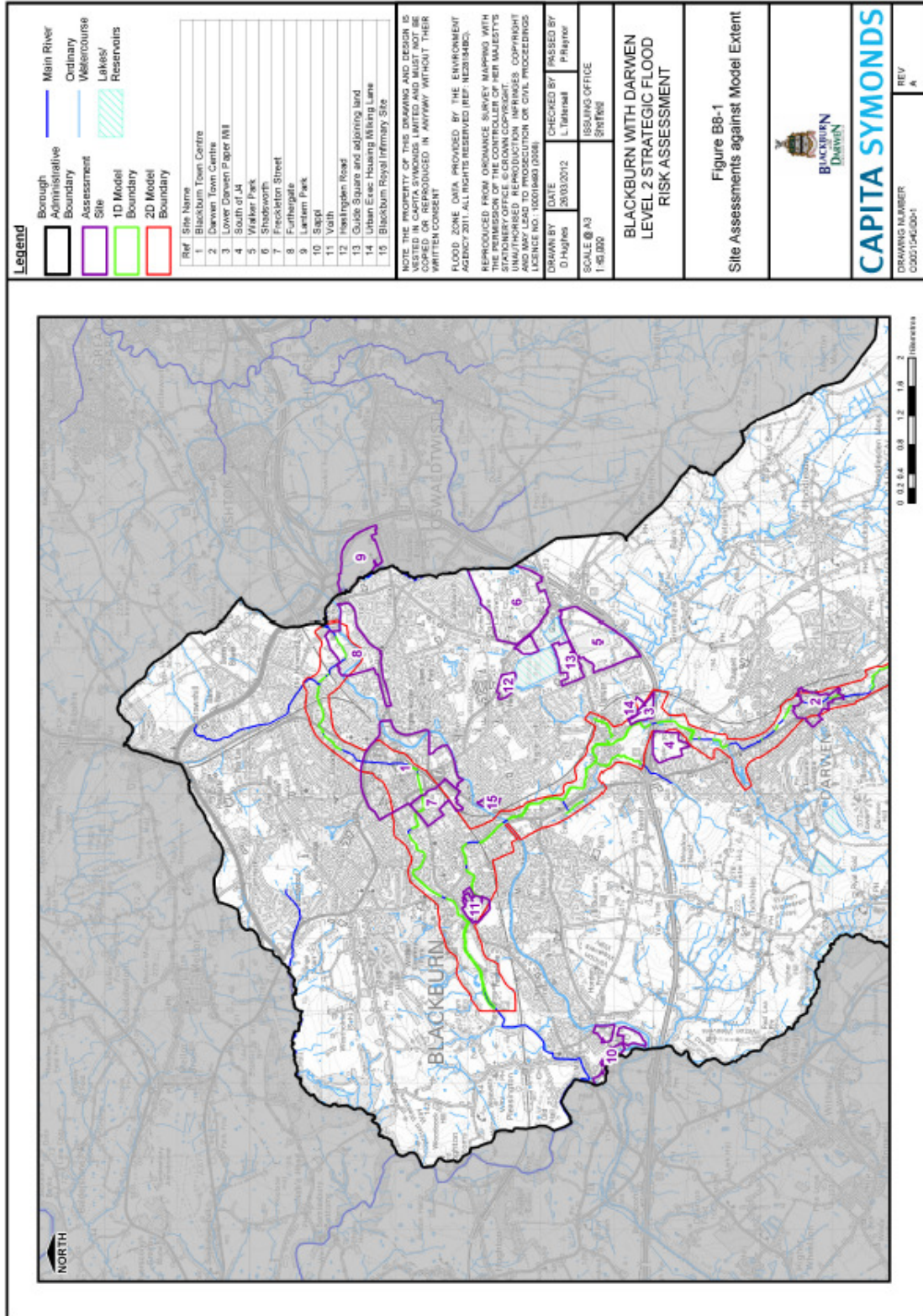
- 6.1.1 Capita Symonds Ltd has been commissioned to prepare a Flood Risk Assessment (FRA) to support the planning application for the redevelopment of part of the existing Blackburn Marketplace as a temporary Bus Station.
- 6.1.2 A significant proportion of the development footprint lies within the current boundary of the Blackburn Markets site. The development will require the demolition of the structures in this area which is currently being considered as a separate exercise, and a planning application has been submitted. A Flood Defence Consent is required from the Environment Agency for any works within 8m of the culverted River Blakewater.
- 6.1.3 The development site lies within Flood Zone 2. Table 1 and 2 of the NPPF indicates that the site would be classified as 'Essential Infrastructure' and is an appropriate land use in Flood Zone 2. It is anticipated that given the nature of the development, there are no alternative appropriate sites at a lower risk from flooding.
- 6.1.4 Model results presented in the Blackburn and Darwen Level 2 SFRA confirm that the site is at risk of residual flooding from an extreme fluvial flood event greater than a 0.1% annual exceedence probability (AEP) event. The site is considered to be at a low risk of actual fluvial flooding from a 1% AEP event and at a minor risk (approx 10-20cm) of flooding from the 1% AEP event plus climate change. The site is considered to be at a low risk of flooding from groundwater sources but at a low to moderate risk of flooding from surface water and artificial sources. There are no reported historical flood records at the site.
- 6.1.5 Spot heights from the provided topographic survey indicate that the site to be above 108.8m AOD. Flood levels within the Flood Zone 3 predicted modelled outline to the south of the site are below 107.15m AOD at the closest point to the site. During a 0.1% AEP event, flood flows are predicted to exceed the capacity of the culvert at Brookhouse Lane and be conveyed across the site from north to south. Depth may reach up to 1,5m in places.

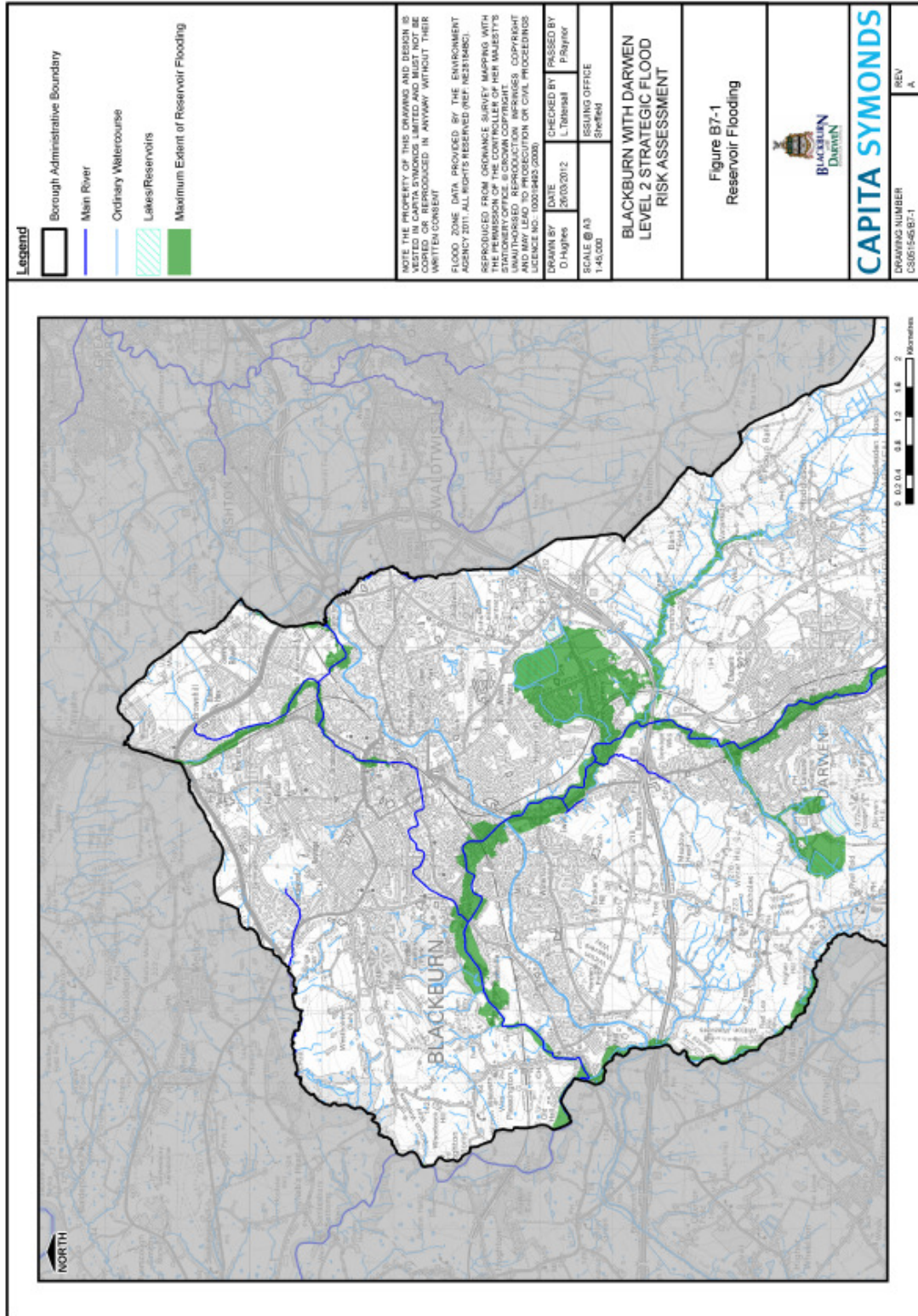
- 6.1.6 Redevelopment plans for the site indicated that there will be no significant increase in permeable areas when compared to the entirely impermeable existing site. possible permeable landscaping is still being discussed and, if implemented, would further reduce the total volume of runoff discharging from the site. As a result there will be no change in the volume or rate of surface water runoff from the site. No mitigation measures will need to be implemented on the site to ensure that flood risk is not increased in the surrounding area.
- 6.1.7 The development proposal has considered flood risk at all stages throughout the development of the final layout and reflects the flood risk constraints and the need to manage, and where possible reduce, flood risk in compliance with the guidance in the NPPF and the Level 2 SFRA. This FRA demonstrates that the proposed development is not at risk of flooding and will minimise the risk of flooding by incorporating additional permeable areas within the development layout. The proposal will not increase the risk of flooding to others and as a result, development at this site should not be restricted as a result of flood risk.

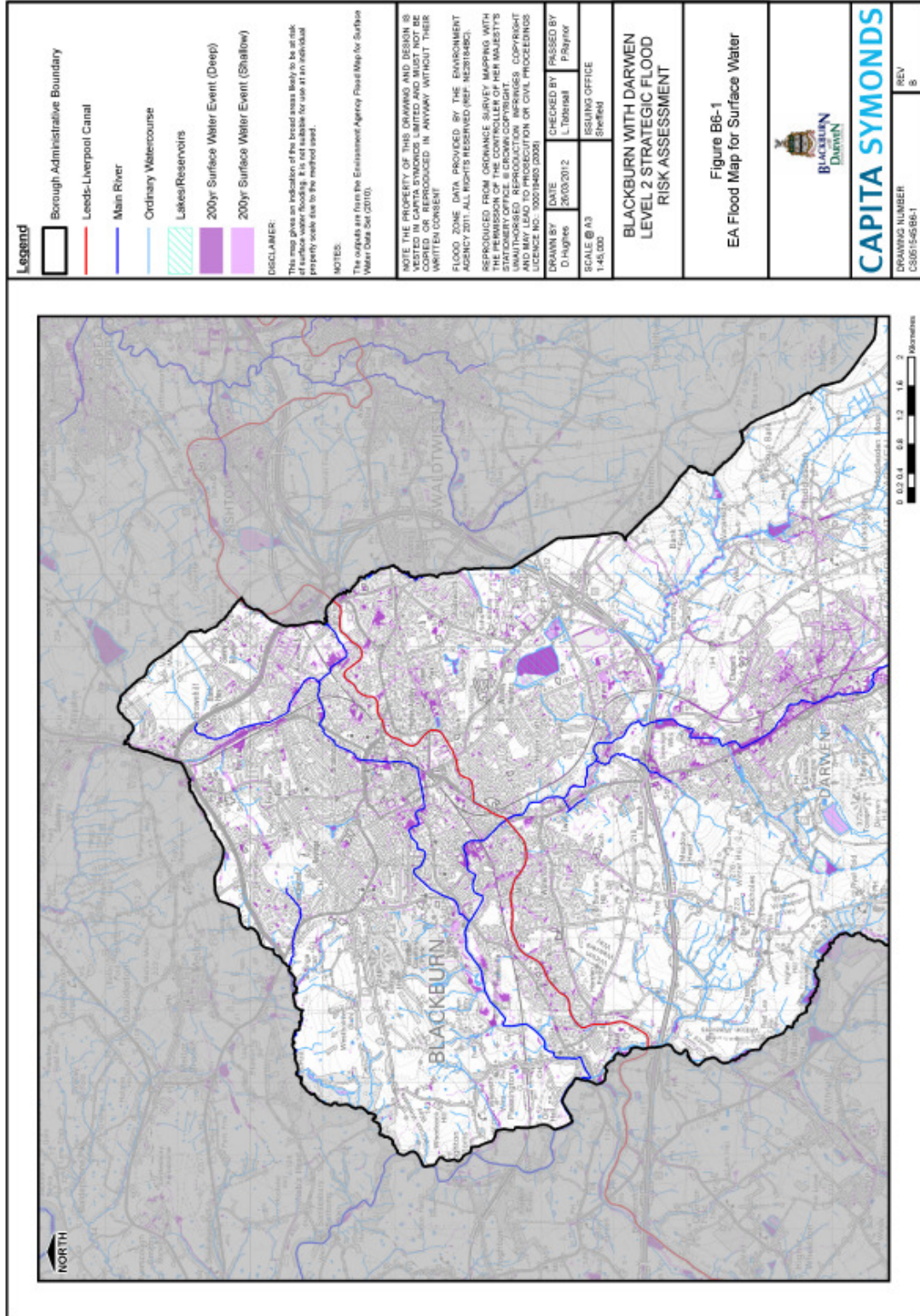
Appendix A

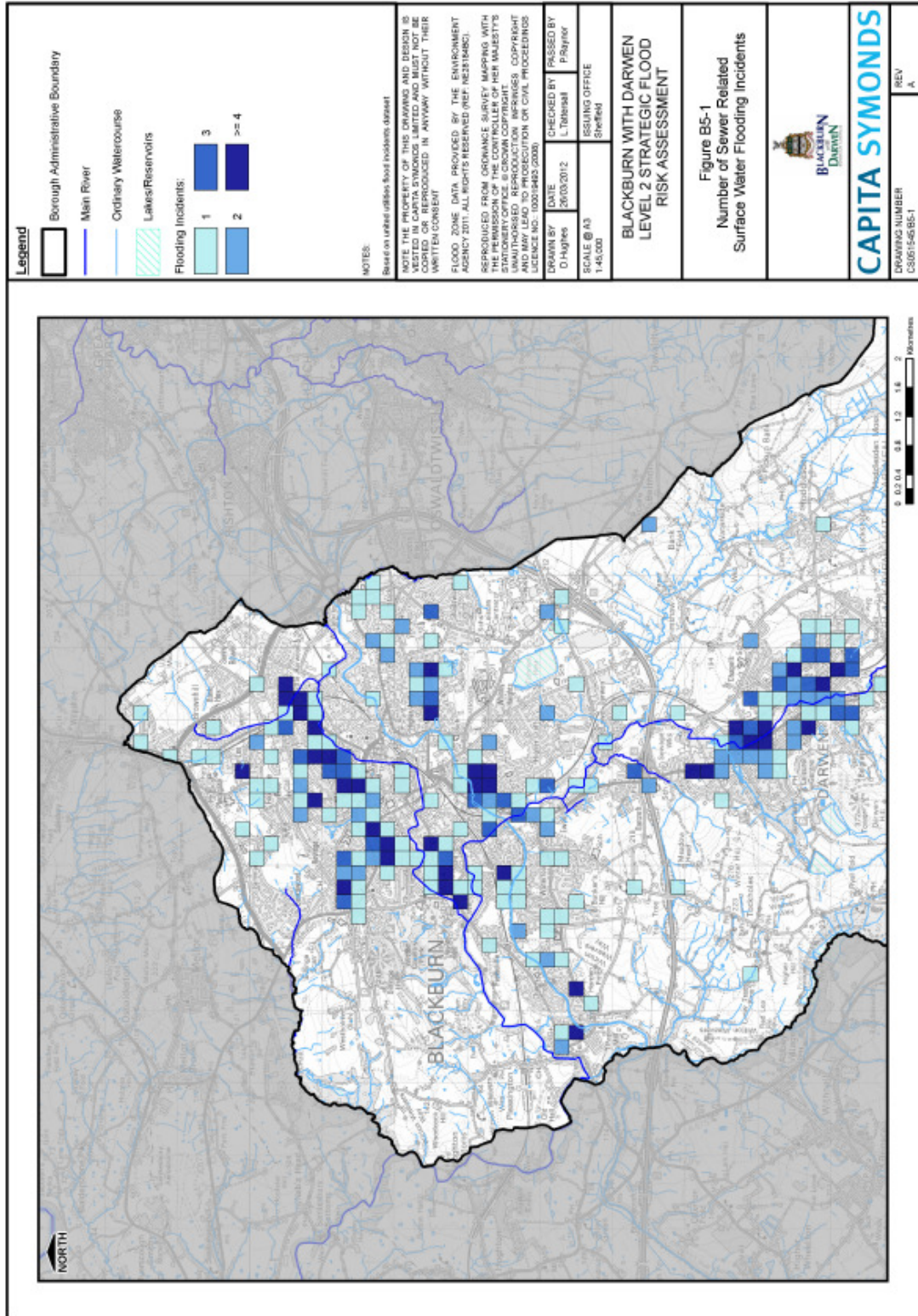
Figures

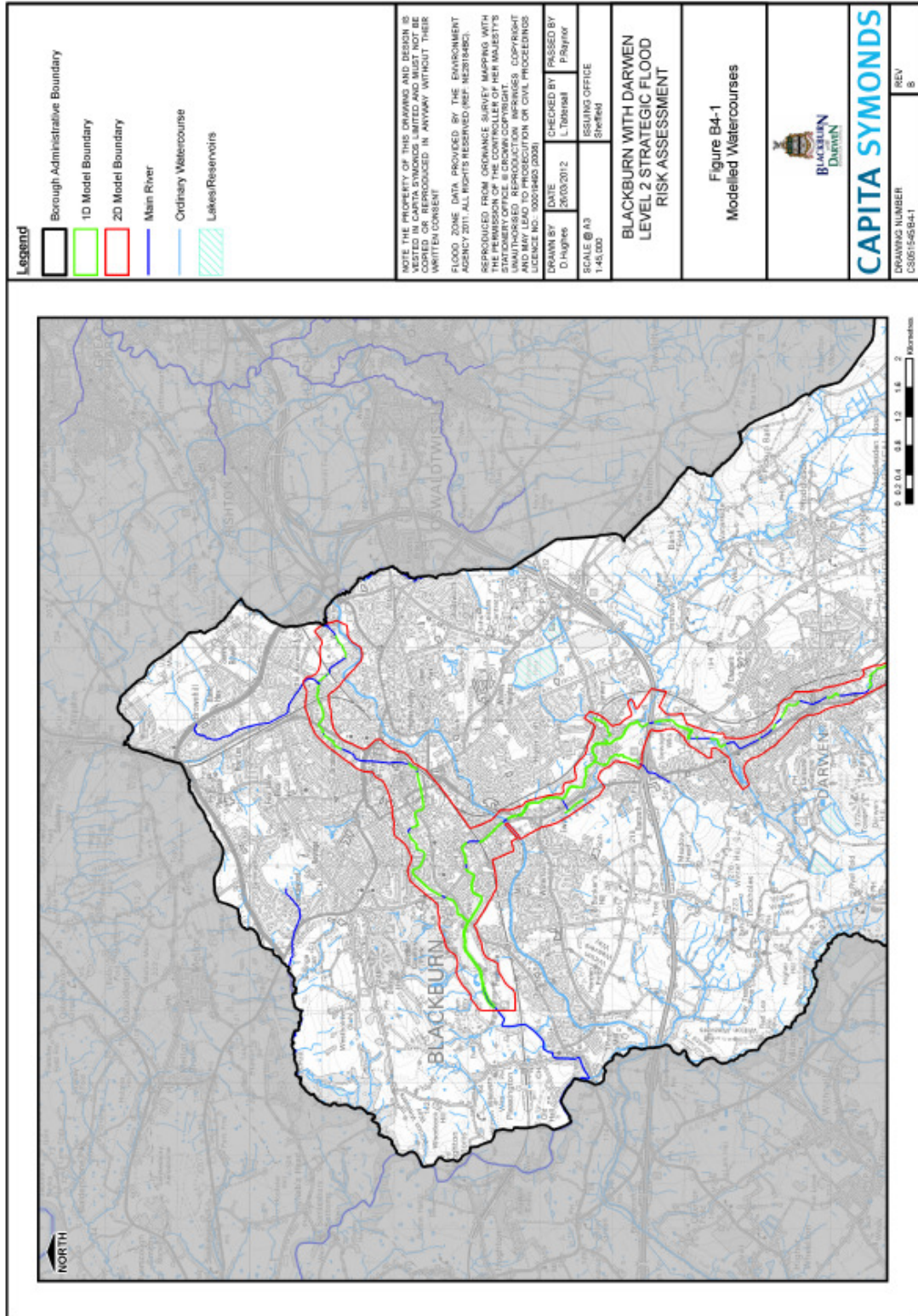


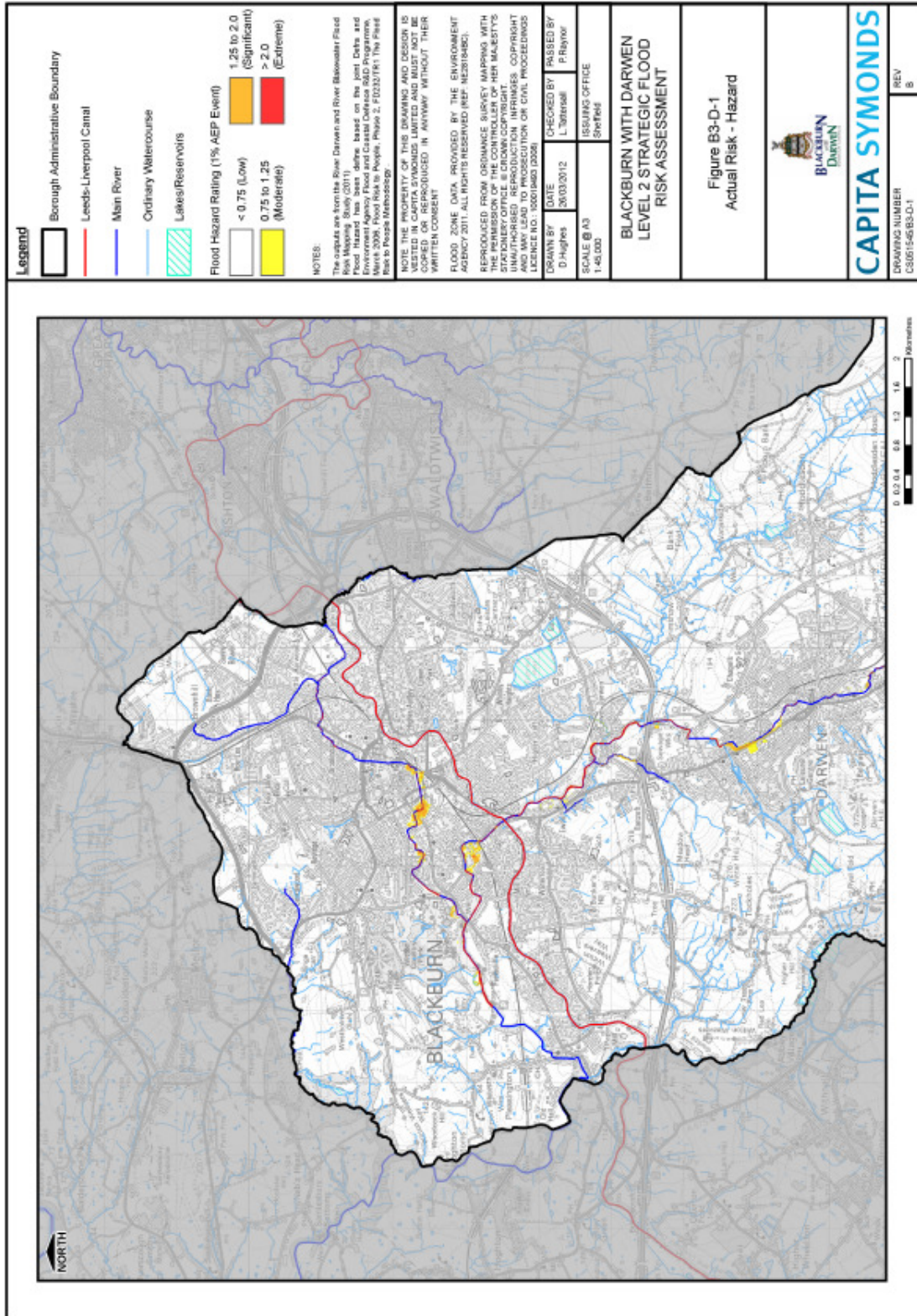


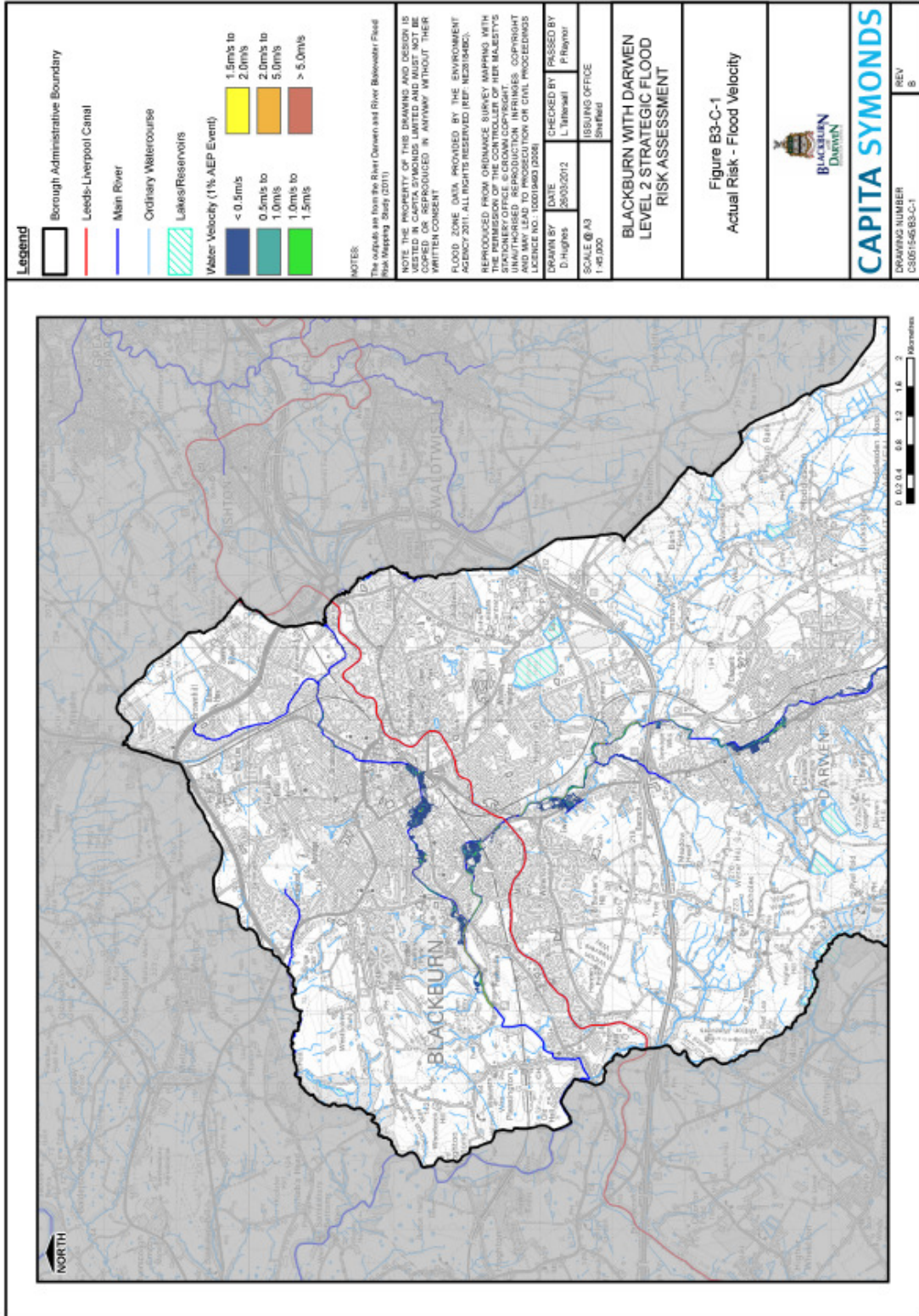


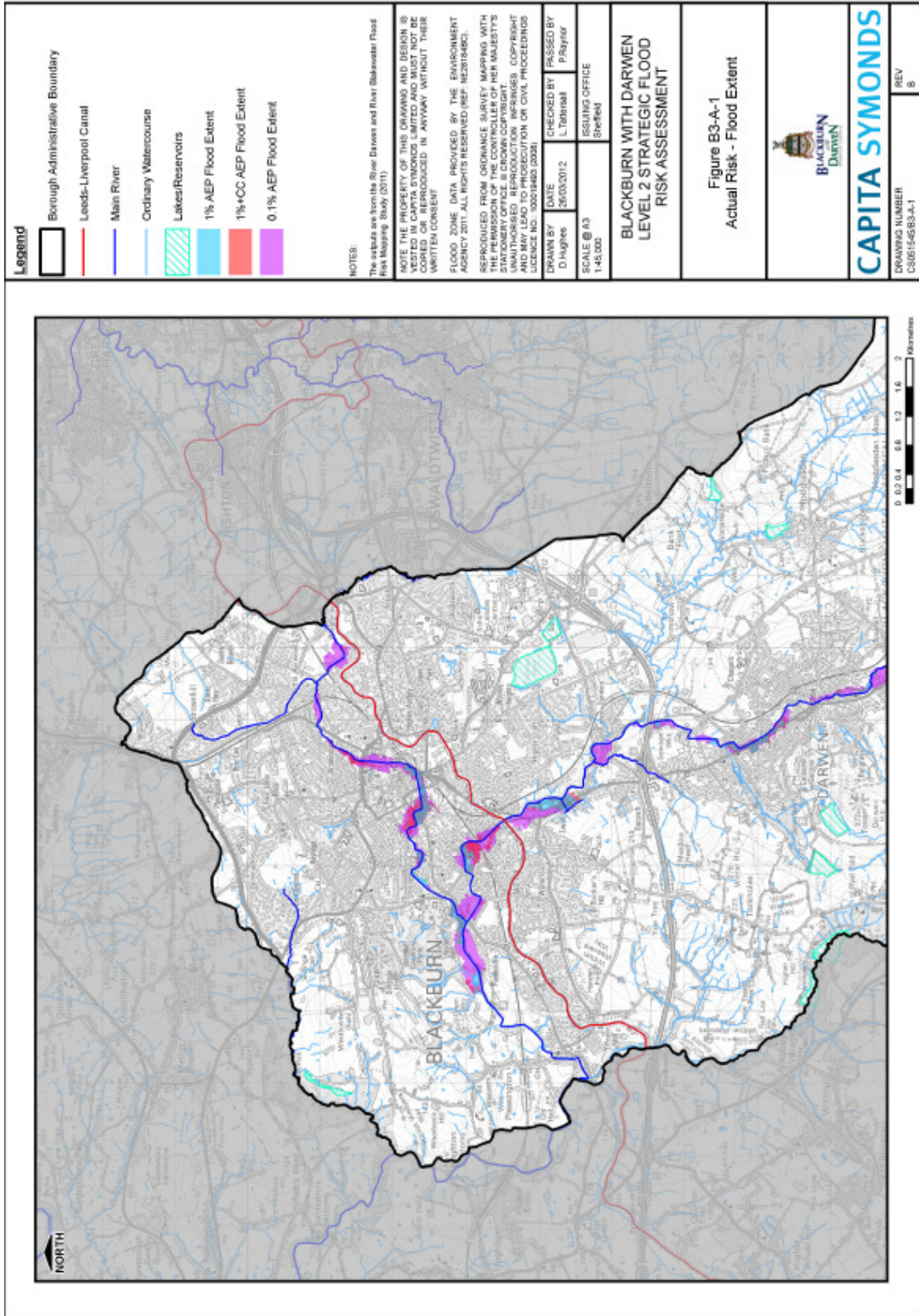


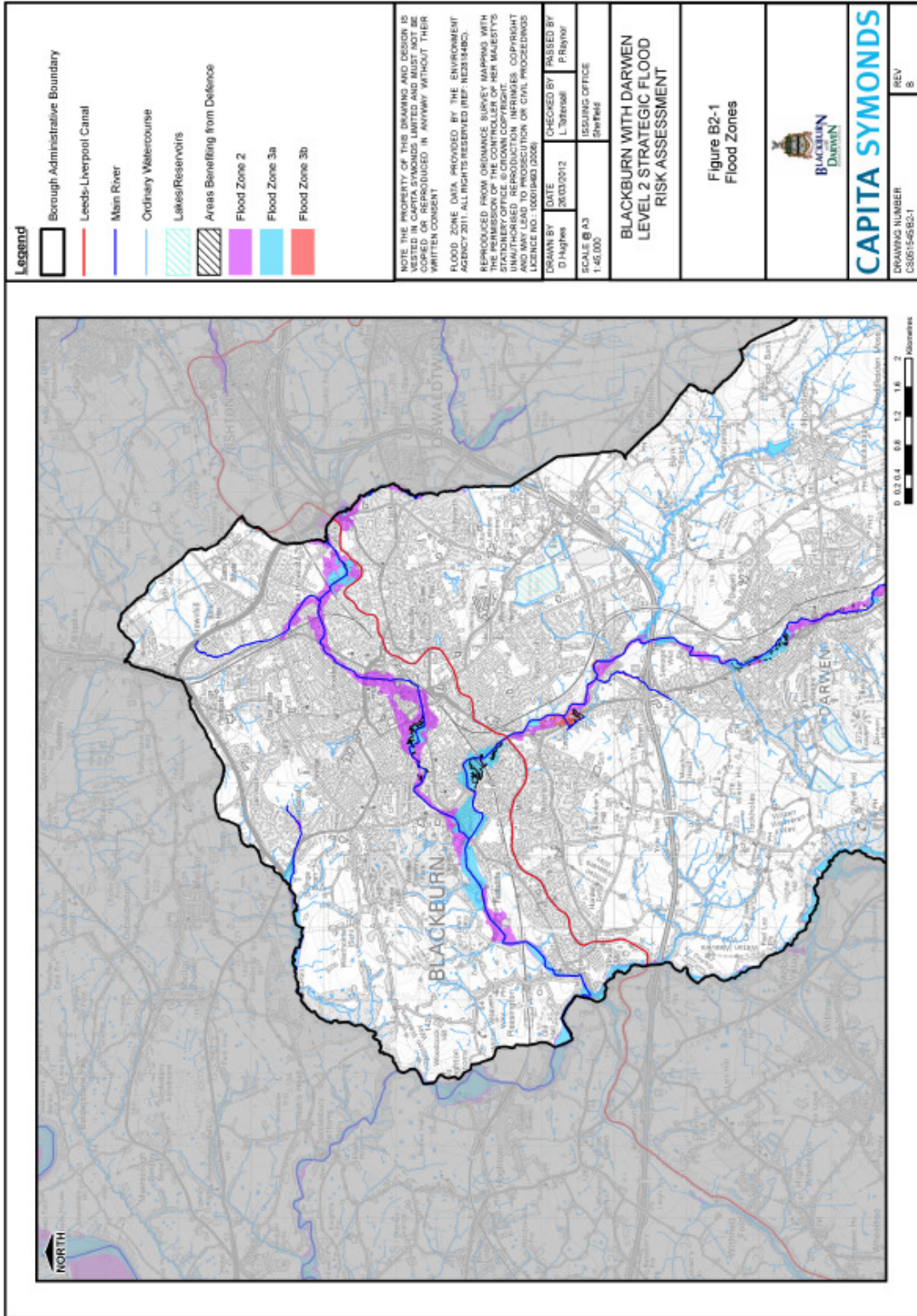


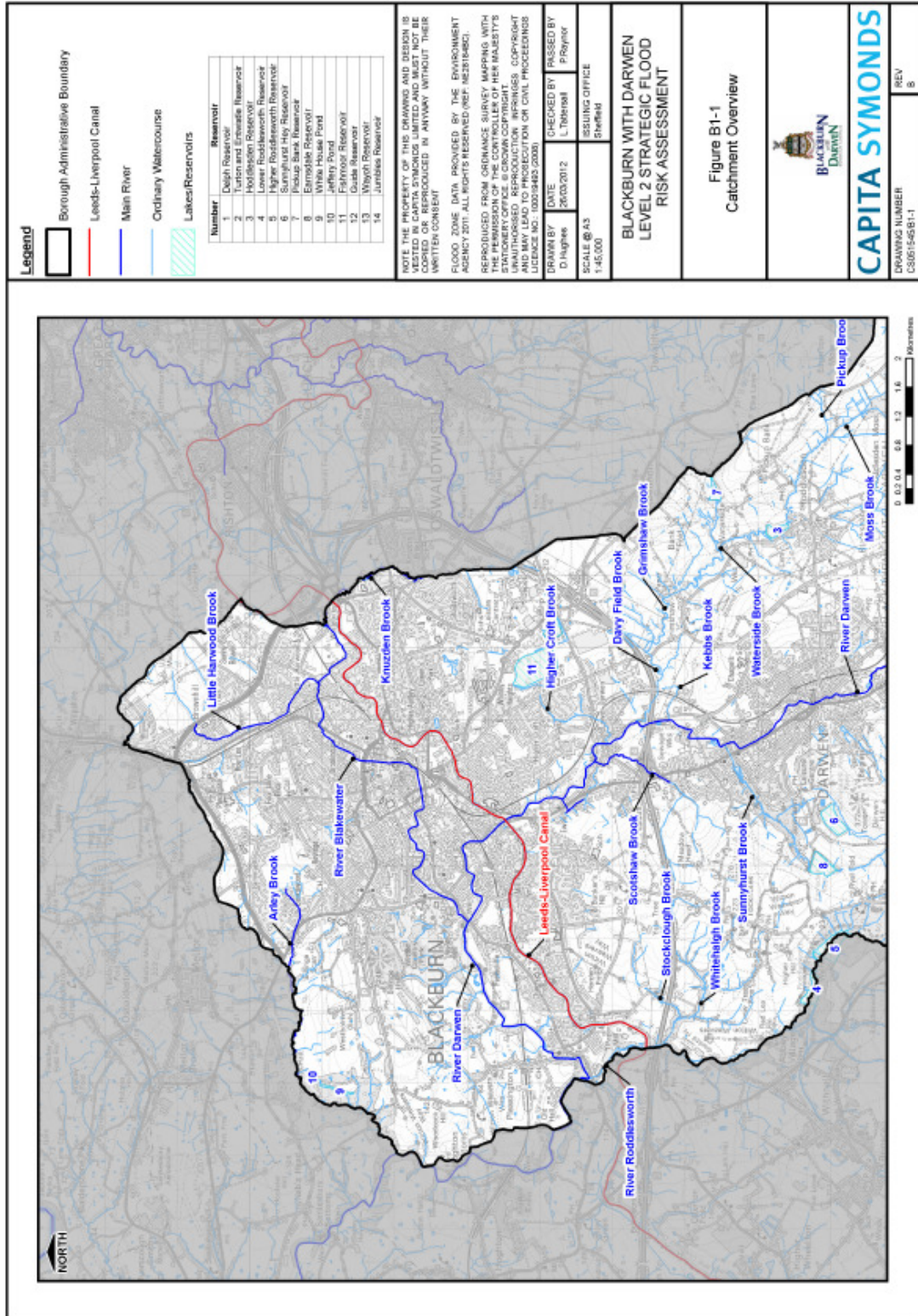












Appendix B

SFRA Site Assessment

Site Number	1	Site Name	Blackburn Town Centre
Site Location	Blackburn	Grid Reference	368290 427880
Location Plan			
Site Description	<p>The Blackburn Town Centre site occupies an area of 110ha. The area contains Blackburn Train Station, the Mall shopping centre, Blackburn College and Blackburn Cathedral along with a number of key access roads and employment sites. The River Blakewater flows into the north of the site in a southerly direction before turning to flow east to west across the town centre and into the Wrangling area. It is in culvert underneath Ainsworth Street and between the Cathedral and the Bus Station. The culvert is understood to have a design standard of 50 years. It is in largely open channel from Bridge Street until it exits the site area at Byrom Street. The Leeds and Liverpool Canal passes through the eastern side of the site for approximately 0.6km before running along the southern boundary</p>		
Development Proposals	Site Options: Employment and Housing	Vulnerability classification	Any housing is considered to be More Vulnerable. Employment is considered to be Less Vulnerable.

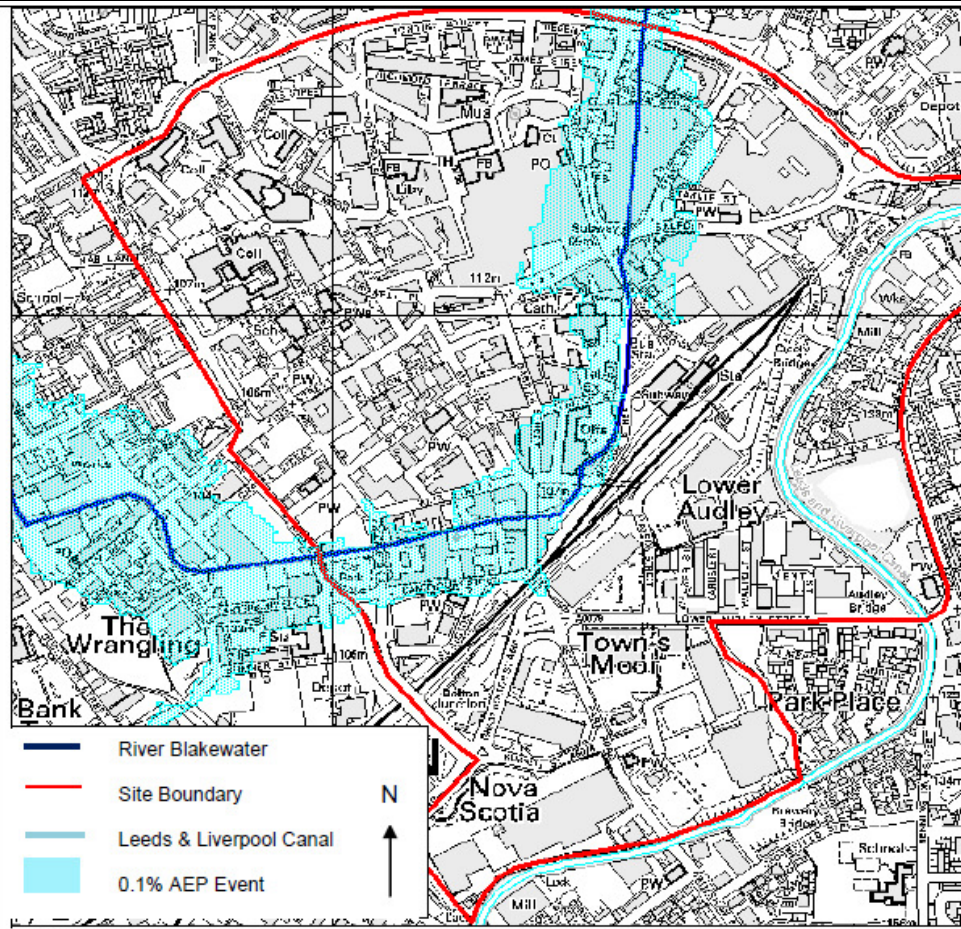
Risk Assessment	
<p>Flood Zone Map Figure B2-1 & B2-2</p>	<p>Much of the site is occupied by Flood Zone 2. All development in this zone is subject to the Sequential Test. Both More Vulnerable and Less Vulnerable development are appropriate without application of the Exception Test.</p>
<p>The map displays the Blackburn area with various flood zones. A red line indicates the site boundary. A blue line shows the River Blakewater, and a cyan line shows the Leeds & Liverpool Canal. Flood Zone 2 is shaded in light blue, and Flood Zone 3 is shaded in dark blue. The map includes labels for 'BLACKBURN', 'Nova Scotia', 'Lower Audley', 'Town's Meor', 'The Wrangling', and 'Bank Top'. A legend in the bottom right corner identifies the symbols for River Blakewater, Site Boundary, Leeds & Liverpool Canal, Flood Zone 2, and Flood Zone 3. A north arrow is also present.</p>	

Sources of Flooding	
<p>Fluvial Figure B3-A-A to B3-A-2 & Figure B3-D-1 to B3-D-2</p>	<p>Actual Risk</p> <p>Hydraulic modelling of the River Blakewater has refined the Flood Zones in comparison to the Environment Agency's Flood Map. The 5% AEP (1 in 20yr) event is shown to be in-channel throughout the site. Flooding is observed north of the railway during the 1% AEP (1 in 100yr) event. In addition the buildings on Canterbury Street and north towards Jubilee Street are inundated. The office buildings at Bridge Street and Darwen Street along with properties on Canterbury Street have a hazard rating of moderate to significant. Data from the NFCDD indicates that there are raised defences on the left and right bank where the River Blakewater leaves the culvert at Bridge Street. The raised defences have a design standard of 35 years and are shown to overtop in the 1% AEP event. West of Mincing Lane the raised defences end and the channel is maintained to a standard of 35 years until it leaves the area at Byrom Street.</p>

Figure B3-A-1 to
B3-A-2

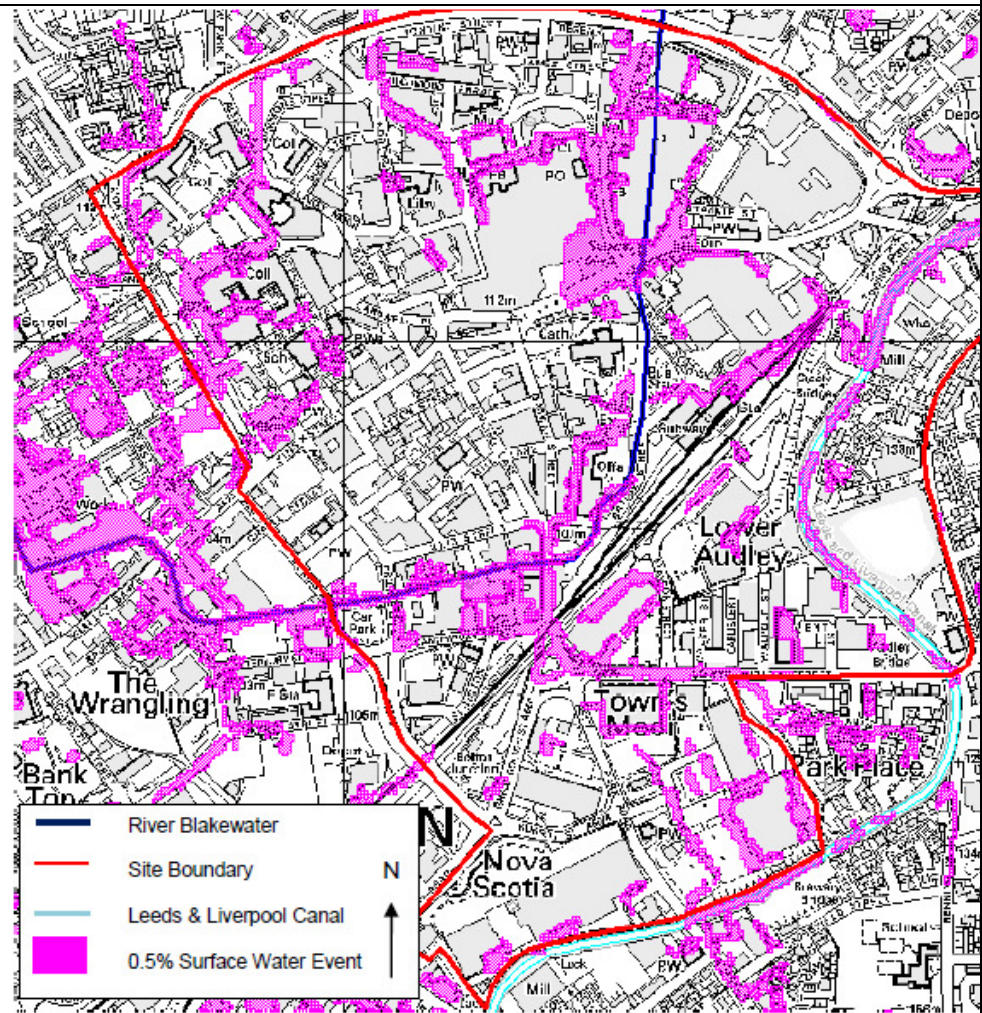
Residual Risk

Detailed modelling of the River Blakewater for the 0.1% AEP event indicates flood waters come out of bank north of the site at Boyle Street close to where the Blakewater goes into a culvert. Overland flow is shown to generally flow along the path of the watercourse through the town centre.



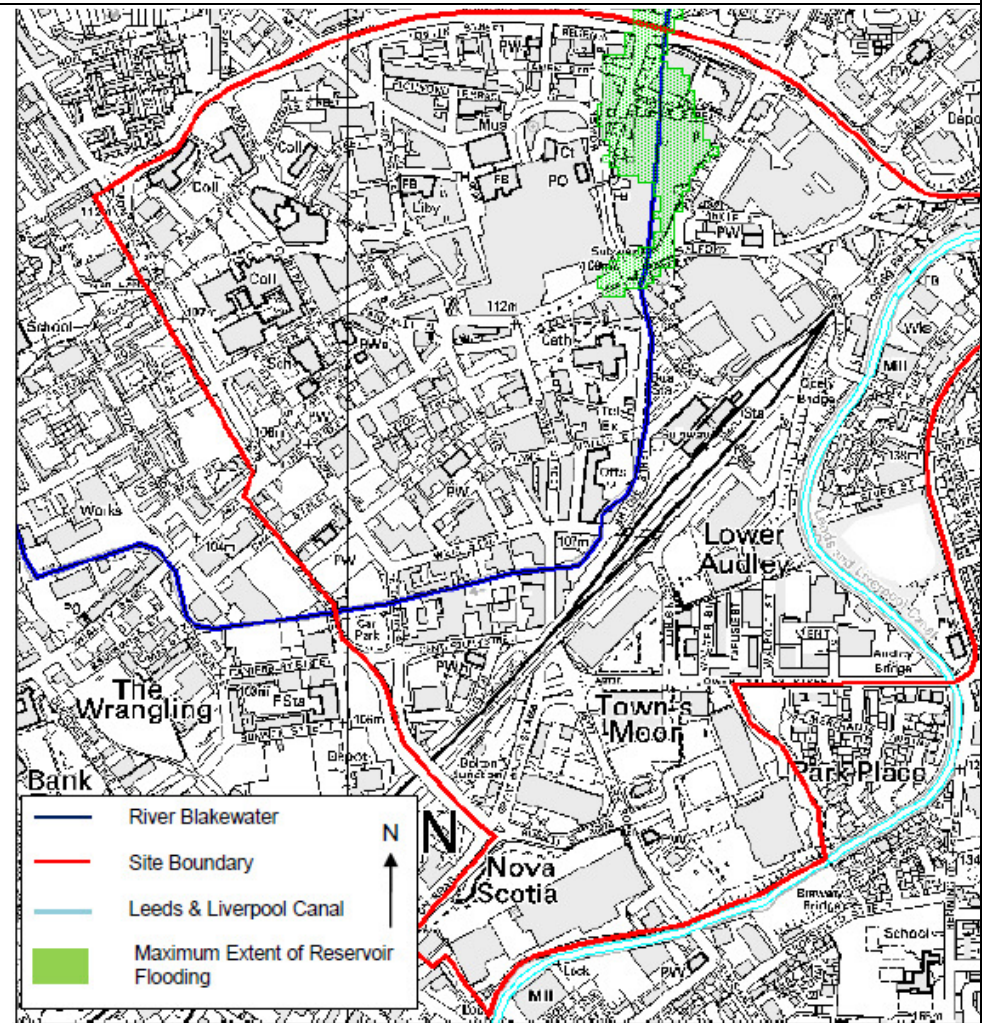
**Surface Water/
Sewer
Figure B6-1 to B6-2**

Surface water is shown to affect the site in a number of locations. For the 0.5% AEP rainfall event surface water flooding typically follows the pathway of the River Blakewater. In addition surface water is simulated to pond along the subway adjacent to The Mall shopping centre. There is also ponding around the college on Feilden Street and south of the railway along Lower Audley Street. Ponding also occurs on the railway around Canterbury Street. The majority of the perimeter roads remain unaffected during this rainfall event. Depths of water up to 0.3m are predicted in the subway at the intersection of Ainsworth Street and Church Street and also the buildings between Weir Street and **Canterbury Street**, and adjacent to the railway at Mayson Street.



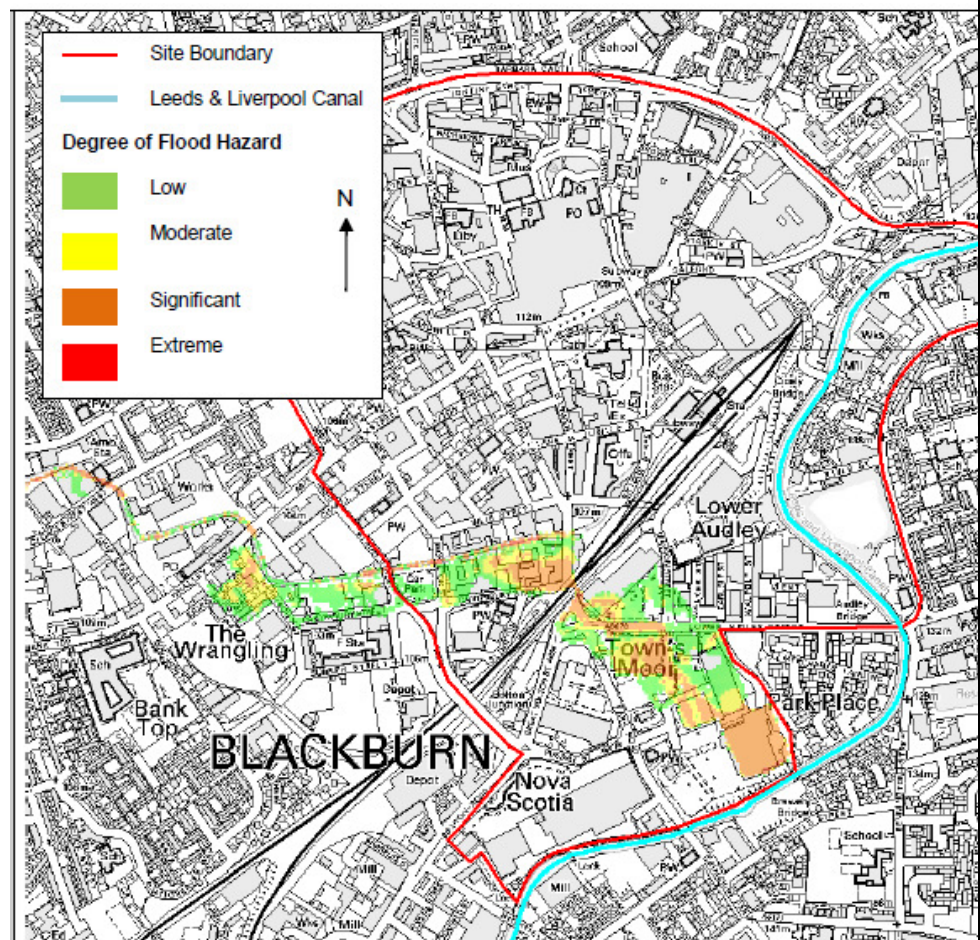
**Artificial Sources
Figure B7-1 to B7-2**

The northern part of the site is shown to be at risk of flooding from a reservoir breach as shown below. A worst-case breach at the Ramsgreave Reservoir to the north of the site is predicted to affect the area of Brown Street, the Market Hall and the car parking area opposite.



Canal Breach

A breach on the Leeds Liverpool Canal was **modelled** adjacent to Brewery Bridge. The building adjacent to the canal on Grimshaw Retail Park is completely inundated by flood waters with water reaching the building within 5-10 minutes of a breach occurring, water depths of 0.7m to 1m are observed within the building complex. Flood waters reach the Towns Moor area within 25 minutes of a breach, where depths are predicted to be up to 0.5m. The breach waters then flow under the railway line (A6177) and join the River Blakewater after 36 minutes. The area between Canterbury Street and the River Blakewater is an area of Significant hazard.



Risk Management	
Assess	<p>A large proportion Blackburn Town Centre is located in the Environment Agency's Flood Zone 2 with none in Flood Zone 3, however, more detailed modelling shows that there is overtopping of the existing defences in a 1% AEP flood event and that parts of the site are located within the high risk 1% AEP event flood extent of the River Blakewater. In addition the detailed modelling shows that the majority of areas bordering the path of the watercourse have a residual risk of fluvial from a 0.1% AEP flood event.</p> <p>The extent of the 5% AEP event (equivalent to Flood Zone 3b, Functional Floodplain) is limited to the channel and is therefore this is unlikely to be a constraint to development. There is however, a risk from surface water flooding in many areas, a residual risk from reservoir flooding upstream of the Cathedral and a residual risk from canal failure in areas within Town Moor and between Canterbury Street and the River Blakewater.</p> <p>In light of the above, development within the areas shown to be within the 1% AEP and 0.1% AEP flood extents could be at risk from fluvial flooding and a detailed flood risk assessment will be required to support any planning application. The FRA should consider the other sources of flooding as well as the residual risks identified.</p>
Avoid	<p>Given the importance of Blackburn Town Centre for redevelopment it is not considered practical to avoid development within those areas shown to be at risk from flooding. However, it is recommended that More Vulnerable land uses be avoided where possible north of Canterbury Street, as this area is shown to be at risk from a number of sources, including a 1% AEP fluvial flood event.</p>
Substitute	<p>The Sequential Test will need to be applied for all types of development within the development site; however, if there is More Vulnerable development proposed within the 1% AEP flood extent than the Exception Test must be applied. Substitution of Less Vulnerable development for any More Vulnerable development within the 1% AEP flood extent is recommended wherever possible. Replacing More Vulnerable uses on the ground floor with Less Vulnerable uses on the ground floor may also be appropriate subject to measures to control and mitigate flood risk.</p>

Control	<p>The design and layout of the proposed development should take into account the different sources and mechanisms of flooding and should seek as much as possible to avoid impacting overland flow routes through the site, which may increase flood risk elsewhere.</p> <p>Finished floor levels should be 600mm above the 1% AEP event plus climate change fluvial flood level OR non-habitable uses should be located on ground floor with habitable accommodation above the maximum 1% AEP plus climate change fluvial flood level. Ground floor levels should be above surrounding ground levels to prevent ingress of surface water runoff.</p> <p>If development that resulted in modification of ground levels was to take place within the 1% AEP flood extent then compensatory flood storage either on site or in the vicinity of the site must be provided.</p> <p>If, following a review of flood depths and the duration of flooding, there is internal flooding to buildings then flood resistance and/or resilience measures should be incorporated into the design of the buildings. Car parking may be appropriate in areas that are inundated providing adequate signs are in place to direct people to emergency exits and depths are not greater than 300mm.</p> <p>The Environment Agency may ask that the full width of its statutory byelaw distance (8 metres) is left undeveloped or that sufficient access is provided so that maintenance and emergency response activities can be carried out (Policy 15 of Volume 1 SFRA Report). British Waterways may ask for a similar set back distance around the Leeds and Liverpool Canal and should be consulted on individual sites.</p> <p>Any works that lie in, over, under or next to a main river or affect existing flood defences on main rivers will require flood defence consent from the Environment Agency under the Water Resources Act 1991 and the current level of flood protection must be maintained throughout those works. Works affecting ordinary watercourses now require the consent of Blackburn with Darwen Borough Council. Additional consents under the Land Drainage Act may be required if a culvert or structure, such as a weir, is proposed to control flow on any ordinary watercourse.</p>
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<p>Mitigate</p>	<p>As individual sites at flood risk come forward, site-specific flood evacuation plans should be developed for review and approval by the Council’s emergency planners. These can be prepared as part of an FRA for the site or conditioned as part of the planning consent to provide information to site users and occupiers on the risks from flooding to the site and the measures in place to manage those risks.</p> <p>In higher risk areas (i.e. within the 1% AEP and 0.1% AEP flood extent) and where the consequences of surface water, reservoir and canal flooding are significant then it is recommended that an ‘information pack’ be provided to occupiers and building managers that would identify, as a minimum, the risk of flooding from all sources, how this will be managed on site, actions site users should take in the event of a flood and appropriate emergency contact details. Due to the large site area, information on safe access and egress routes and refuge areas for individual developments will need to be developed further using information collated and developed by the site-specific FRA. These information packs could be conditioned as appropriate.</p> <p>Part of the site lies within an envelope of reservoir inundation and in an area potentially at risk from canal failure. The council’s emergency planners should be consulted to determine if a development will be considered safe and therefore pass the Exception Test (Policy 22 of Volume 1 SFRA Report). British Waterways should be consulted for further information on the probability of failure of its assets.</p>
<p>Can development reduce flood risk overall?</p>	<p>Flood Defence Infrastructure</p> <p>The design standard of the culvert and the maintained channel in the Town Centre when they were constructed was a 2.8% AEP (1 in 35 year) flood event. Detailed modelling indicates that overtopping of these defences occurs above the current 4% AEP (1 in 25 year) flood event and it is likely that this Standard of Protection will deteriorate further as the impacts of development within the catchment and climate change are realised.</p> <p>It is recommended therefore that Blackburn with Darwen Council should explore possibilities as development sites come forward to secure developer contributions to maintain/upgrade the defences in line with EA Policy (Policy 14 and 23 of Volume 1 SFRA Report). Improvement of flood defences in this location may provide benefits to the Freckleton Street Area downstream, though care is needed to prevent increased flood risk elsewhere.</p> <p>In addition to improving existing defences there may be opportunities to open up the River Blakewater channel in the Town Centre. De-culverting and re-naturalisation would help to increase the capacity of the channel along sections of the river and may help to meet the requirements of the Water Framework Directive (WFD), however, de-culverting should be applied with caution and in conjunction with defence improvements in this area as there is a risk of increased flood risk within the development site and to downstream areas.</p>

	<p>Surface Water Management and Sustainable Drainage</p> <p>The Floods and Water Management Act 2010 establishes a Sustainable Drainage Systems Approving Body (SAB) that must approve drainage systems in new developments and redevelopments before construction begins. Once this element of the Act is enacted all surface water drainage systems must be designed and constructed in accordance with new National Standards for SuDS and the most up-to-date version of Sewers for Adoption.</p> <p>Until the enactment of this element of the Act, it is recommended that the following principles are adopted, including:</p> <ul style="list-style-type: none"> • A Surface Water Flood Risk Assessment should be undertaken on all sites in compliance with the NPPF and local requirements. • All new sewers should be designed to meet the requirements of the latest version of Sewers for Adoption. • New Brownfield development should seek to reduce peak runoff by at least 50% from the existing, achieving this through discharging to soakaways as well as through the provision of storage and flow restriction devices that discharge at low rates. Where this level of runoff reduction is not practicable, the developer must provide appropriate evidence to that effect and must show that the maximum reduction that can be achieved from the site is being proposed. At the very least development must not increase runoff rates above existing • All new development to include at least one 'at source' SUDS measure. Where no "at source" SUDS measure is proposed, provide evidence to show that such measures are not feasible as a result of existing ground conditions. <p>Blackburn Town Centre falls within a defined Critical Drainage Area (CDA); therefore the above measures are recommended to reduce flooding in this critical area (refer to section 4.3.3 of the Volume 1 SFRA Report). The use of infiltration methods must also be balanced against groundwater and contaminated land issues on Brownfield sites.</p>
<p>Is the Site Sensitive to development elsewhere?</p>	<p>Areas that are shown to be at risk from fluvial sources are potentially at risk from new development and works that could increase the conveyance capacity of the upstream culverts or restrict the conveyance of downstream culverts.</p> <p>Areas that are shown to be at risk from surface water runoff may be sensitive to increasing urbanization within the catchment.</p>

Appendix C

Correspondence

Losty, Andrew Thomas (Capita Symonds)

From: NW North Information Requests [NW_North_Information_Requests@environment-agency.gov.uk]
Sent: 25 March 2013 14:35
To: Losty, Andrew Thomas (Capita Symonds)
Subject: RE: Enquiry regarding Ref: PROTECT-NTH6608H. 'Brown Street Temporary Bus Station'

Dear Andrew

Many apologies for not replying sooner. There was a breakdown in communication in that I thought the relevant Environment Officer had replied to you directly.

I have chased him and he has confirmed that he has read through the plans for this scheme and he has no issues with your proposals for the proposed surface water discharge. So in essence we are happy with what you propose.

We hope this clarifies matters for you.

Many thanks.

Helen Reynolds
Customer Services Officer
Customer Services Team North West
Environment Agency
Ghyll Mount, Gillan Way, Penrith 40 Business Park, Penrith, Cumbria, CA11 9BP
Telephone: 01768 215848
Email: Nwnorthinformationrequests@environment-agency.gov.uk

Losty, Andrew Thomas (Capita Symonds)

From: Planning Liaison [Planning.Liaison@uuplc.co.uk]
Sent: 19 March 2013 15:49
To: Losty, Andrew Thomas (Capita Symonds)
Subject: RE: Brown Street Temporary Bus Station

Hello Andrew

I have no issue with your proposal to drain surface water to a culverted watercourse as the watercourse is not our asset. I would suggest that you speak to the EA to agree discharge rates

thanks

Graham Perry
Development Engineer
Developer Services and Planning
Business Operations
United Utilities
T: 01925 678311 (internal 78311)
unitedutilities.com