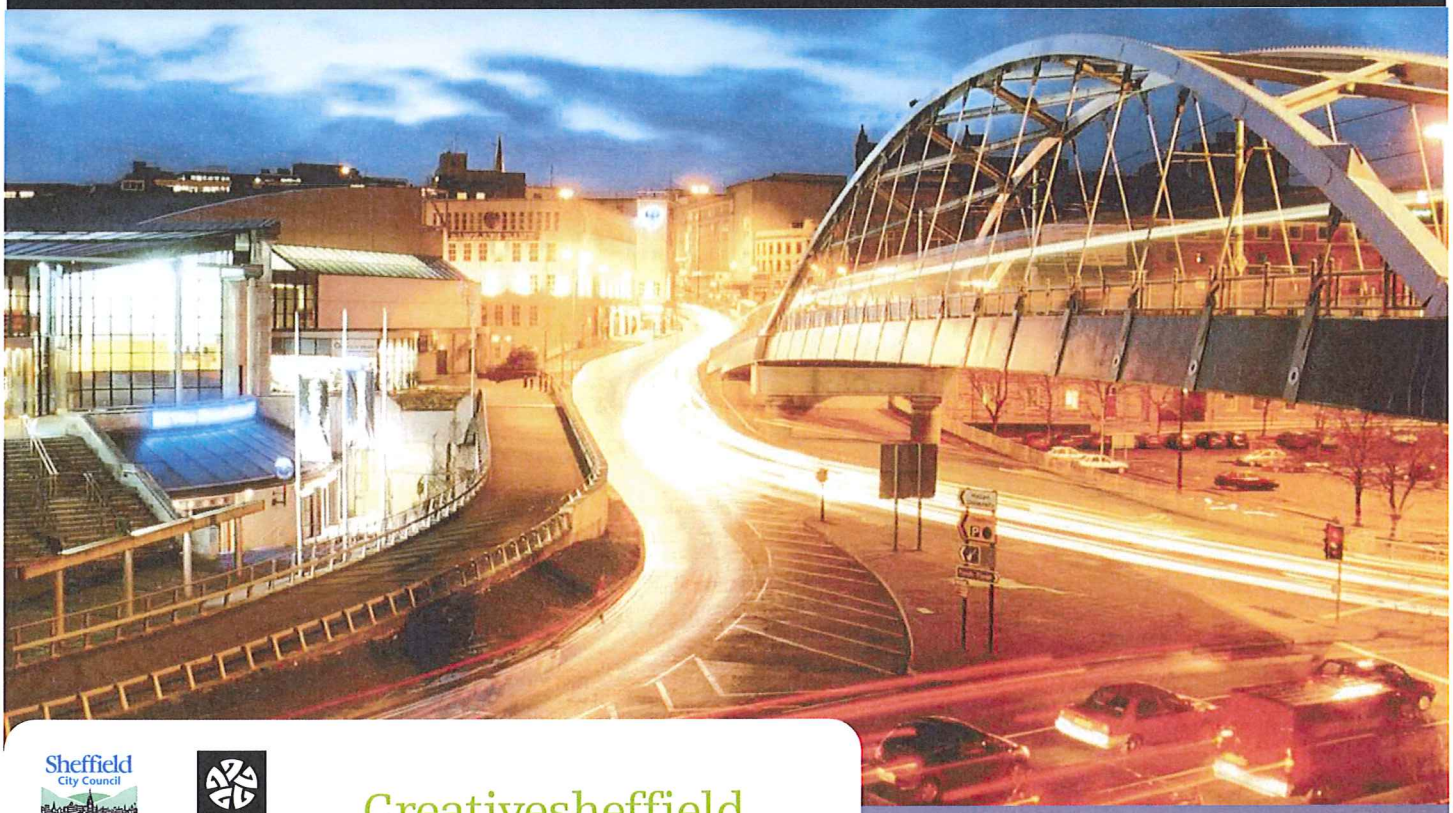
WYG Engineering

part of the WYG group

Sheffield Energy and Water Infrastructure Study

Flood Risk Study

Rev B – 18th June 2010.



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Contents

1.0 Executive Summary

The Flood Study review has identified the following:

1.1 That of the 322 allocated sites, 28 No. were located within Flood Zone 3. Of these 19 No. were located within Flood Zone 3a, six were within Flood Zone 3a(i) and two within Flood Zone 3b. 46 No. were located within Flood Zone 2, with the remaining 248 allocated sites all being located within Flood Zone 1.

1.2 Based on the screening by clusters, nine elements of critical infrastructure were located within Flood Zone 3 of which two were located within Flood Zone 3b and the remaining elements located within Flood Zone 3a. No elements were located within Flood Zone 3a(i)

1.3 In respect of future development of any of the allocated sites located within Flood Zone 3, preference should be given to sites within Flood Zone 3a over Flood Zone 3a(i). No development will be allowed, except for water compatible use or essential infrastructure within Flood zone 3b.

1.4 The Don Catchment Flood Management Plan has identified that at present the area is defended to a 5% AEP and is at continued risk from flooding, in particular the City Centre and areas along the main rivers within the city. The CFMP proposes to take further action to reduce flood risk and has identified the need to undertake further studies and preparation of action plans in order to better understand the mechanisms of flooding and to develop ways of controlling the risk of future flooding, in particular taking into consideration the impacts of climate change.

1.5 The CFMP also identified the need for the Environment Agency to adopt a partnership approach with potential developers to allow the Environment Agency to achieve their expectations within Sheffield on what can be done to manage flood risk and ensure sustainable growth of the city and the region. By working with the Environment Agency, it may be possible to consider development of the water front sites in such a way as to maximise benefit to both parties in terms of flood management and capital investment on flood protection works.

1.6 Following consultation with the Environment Agency and Sheffield City Council, Flooding Section it was identified that several flood protection schemes are planned or have commenced. These being at Wicker, Nursery Street and at Kelham Island and a review of these schemes, and their implications upon any critical infrastructure within the relevant cluster, will be undertaken once detailed information has been provided by Sheffield City Council. There are also ongoing maintenance works to the main rivers within the city to ensure that they are kept clear of vegetation and blockages.

1.7 A strategic overview of Flood Protection is expected to be provided by the Environment Agency's Don Catchment Plan and Sheffield Strategy which are both due for publication later in 2010 and the implications of any new works on the existing critical infrastructure will need to addressed once the overview has been completed.

1.8 As identified through the screening process, there are certain elements of critical infrastructure i.e. primary sub stations, sewage treatment plants, gas holders and sewage pumping stations) that are at risk from flooding within the 1% AEP zone.

1.9 Based on the above and the issues identified in the report, we would make the following recommendations:

1.10 The sequential approach as set out in PPS25 is adopted in considering the sites to be developed i.e. sites with a lower flood risk (i.e. Flood Zone 1), taking priority of sites in Flood Zone 2.

1.11 That in developing their strategy for the development of any waterside allocated sites located within Flood Zone 3, that Creative Sheffield ensure that priority is given to sites located within Flood Zone 3a over Flood Zone 3a(i). It is not anticipated that the development proposals will be to develop water compatible developments or essential infrastructure and therefore no development should be considered within Flood Zone 3b.

1.12 Any development proposals associated with development within Flood Zone 3 or 2 should include a flood risk assessment which addresses the needs for any sequential or exception test as deemed necessary by the specific nature of the development proposal.

1.13 To assess the specific implications of where the nine elements of critical infrastructure were identified within Flood Zone 3, that further details are obtained from the relevant infrastructure provider to assess what flood protection or flood resilience measures have been provided or are proposed and to identify any specific allocated sites that are vulnerable as a result of failure of the facility.

1.14 Establish a formal dialogue with the Environment Agency and Sheffield City Council's Flood Section to identify their programme for completion of the Surface Water Management Plan (SWMP), the Strategic Flood Management Plan (SFMP) and the System Asset Management Plan (SAMP).

1.15 Through this dialogue and on completion of the three studies to work in partnership with the Environment Agency and Sheffield City Council to review the implications of development of the allocated sites within Flood Zone 3. Where any flood protection works are proposed, then these would be most appropriately developed in partnership with the two authorities.

2.0 Terms of Reference

2.1 WYG Engineering were appointed by Creative Sheffield (Sheffield's Economic Development Agency) to provide an addendum to the main Sheffield Energy and Water Infrastructure Study to consider the flood risk in relation to the Critical Infrastructure within the main study area.

2.2 The brief for this addendum agreed with Creative Sheffield and was as follows:

a) Include flood map data from the post 2008 floods SFRA onto the GIS data.

b) Include on the individual site data sheets a number of columns with a simple tick (if applicable) to indicate (in the relevant column) if the flood zones (as per the SFRA) are found within the site footprint (This will not indicate proportion in each zone or anything else; the intention is as a 'first screening' exercise to identify if there is a fluvial flood risk issue or not).

c) Provide a first level assessment of impact of flood zones on identified critical/strategic infrastructure on the basis of an overlay of the SFRA mapping with GIS data from the study of critical/strategic infrastructure.

d) Review the relevant sections of the Don and Rother Catchment Flood Management Plan (CFMP) to identify which elements of the associated strategic action plan have a potential impact on the sites that are included within the infrastructure study.

e) Liaise with the EA to discuss the interfaces and to discuss (a) potential for schemes to be brought forward in programme (b) increased in scope to align with Sheffield Infrastructure Objectives and (c) promotion of schemes (to release development land) not identified within the CFMP but where there may be synergy of purpose with EA objectives identified in the CFMP.

f) Review with City Development Division any interface between SCC flood defence work and the individual sites.

3.0 Methodology

3.1 Flood Risk Screening

3.1.1 The study area has been broken down into 322 separate allocated sites, with each site being grouped into a larger cluster site. In total there are 52 cluster sites.

3.1.2 An initial screening will be undertaken to identify the status of each allocated site in relation to flood risk. The baseline data to be used for this screening will be the Environment Agency flood maps as of November 2009.

3.1.3 This initial flood zone screening will identify the allocated sites into five elements in accordance with the definitions as set out in PPS 25 development & Flood Risk and the Sheffield City Council Level 1 Strategic Flood Risk Assessment

a) Flood Zone 1 – land assessed as having a less than 1 in 1000 annual probability of river flooding (<0.1%)
b) Flood Zone 2 – land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%)
c) Flood Zone 3a – land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%)
d) Flood Zone 3a (i) – land assessed as having a 1 in 20 or greater annual probability of river flooding (>1%) where there are existing buildings that are considered to be impermeable to floodwaters. It is important to recognise that land surrounding these buildings are critical paths and /or flood storage areas and must be retained.
e) Flood Zone 3b - land assessed as having a 1 in 20 or greater annual probability of river flooding (>5%) where flood water has to flow or be stored in times of flooding.

3.1.4 Based on the above screening a spreadsheet will be prepared detailing each allocated site with its flood risk rating and the cluster area it is located within.

3.2 Review of Critical/Strategic Infrastructure and Associated Flood Risk

3.2.1 The elements of critical/strategic infrastructure to be assessed in respect of flood risk will follow that previously adopted under the main Energy & Water Infrastructure Study and will include the following:

a) Central Networks East – Primary Sub Stations
b) National Grid – Towers and Main Sub Stations
c) YEDL – 600/400/250 & 132KV main Sub Stations
d) YEDL – Primary Sub Stations
e) National Grid – Gas Holders, Above Ground Installations (AGI) and intermediate to Medium Pressure Regulators
f) Yorkshire Water – Sewage Treatment Works/Sewage Pumping Stations and Surface Water Pumping Stations.
g) Severn Trent – Water Pumping Facility
h) Telephone Exchanges – Enabled and Not Enabled Exchanges. Note that the enabled exchanges are ones that have already been upgraded to provide high data capacity and transmission.

3.2.2 In undertaking this screening it is proposed that instead of reviewing each allocated site to locate what critical/strategic infrastructure is present, that each cluster would be analysed instead. This holistic approach is considered more realistic as the critical infrastructure will in general serve the larger cluster area, rather than the macro areas provided within the allocated sites.

3.2.3 The above information will be presented in a spreadsheet with each element of critical infrastructure being identified where it lies within either Flood Zone 2 or 3. As any strategic infrastructure located within Flood Risk 1 (i.e. <0.1% annual probability) it is deemed to be at low risk of flooding and subsequently at low risk of failure and therefore these elements have not been screened in respect of flood risk.

3.3 *Review of Current Catchment Flood Management Plans*

3.3.1 Based on the output from the above screening, a review will be undertaken of the Don Catchment Management Plan published by The Environment Agency in December 2008.

3.3.2 Where this document identifies any current or future works in relation to flooding or improvement works, these will be reviewed in the context of the screening findings.

3.4 *Liaison with The Environment Agency and Sheffield City Council, Flooding Section.*

3.4.1 Following the flood screening process contact will be made with the two parties above to identify any capital works or maintenance works proposed that impact on the possible reduction of the flood risk identified for each element of critical infrastructure.

3.4.2 Comment will be made on the implications of the works identified and how these may be considered in reducing the risk of flooding to the individual element of critical infrastructure.

3.4.3 Where relevant the proposed programming of the above works will be assessed and commented on.

3.5 Discussion of the Critical Infrastructure in Relation to Flood Risk.

3.5.1 This section will review current DERFA and Environment Agency guidelines in respect of critical infrastructure and flooding and consider the impacts of these on the elements of critical infrastructure identified as being at risk from flooding.

3.5.2 Comment will also be made in relation to how the elements of critical infrastructure as identified through the screening process will impact on the individual allocated sites.

4.0 Review of Flood Risk Screening

4.1 *Initial Flood Screening of Allocated Sites*

4.1.1 The initial flood risk screening was undertaken of all 322 allocated sites and the results of this screening are contained in Table 1 contained in Appendix A.

4.1.2 The screening identified that of the 322 sites, 28 were within Flood Zone 3 and of these, 19 were in Flood Zone 3a, six were in Flood Zone 3a(i) and two were in Flood Zone 3b. In respect of Flood Zone 2, 46 were allocated sites located within this Flood Zone. The remaining 248 sites were all located within Flood Zone 1.

4.1.3 The location of flood zones and the allocated sites are shown in Appendix B

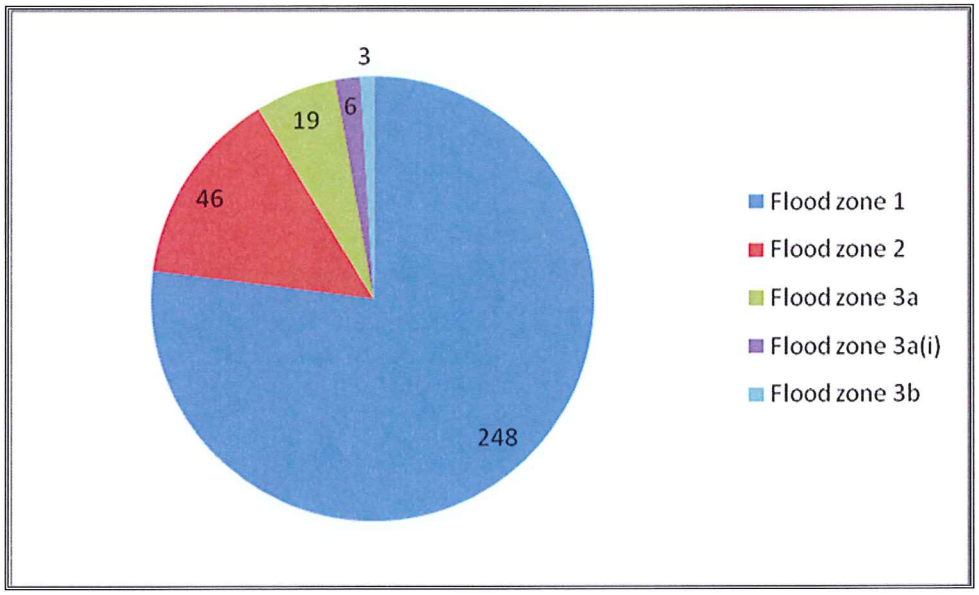

Figure 1 - Summary of Allocated Sites in Respect of Flood Zoning.

4.1.4 The above screening identified that only 8.7% of the allocated sites were located in areas of high flood risk (i.e. 1% or greater) and that of these only three sites were located within Flood Zone 3b (i.e >5% annual probability of flooding where flood waters are stored).

4.1.5 The screening also identified that 14.2% of the sites were located within Flood Zone 2 (i.e annual probability of flooding between 0.1 and 1%). The remaining 77% being located within Flood Zone 1 (i.e.<0.1% annual probability of flooding)

4.2 Screening of Critical/Strategic Infrastructure within Flood Zones.

4.2.1 In order to identify what elements of the critical/strategic infrastructure are at risk from flooding, these were screened against Flood Zones 2 and 3.

4.2.2 As the critical infrastructure operates on a larger area to that of the allocated sites, it was decided to screen these initially based on the cluster areas. Where the critical infrastructure is located outside of

Flood Zones 2 and 3, it was accepted that as these were at low risk (i.e <0.1% annual probability of flooding), and a detailed analysis was not required.

4.2.3 The results of this screening are contained in Table 2 contained in Appendix C.

4.2.4 The location and details of the critical infrastructure within Flood Zones 2 and 3 are shown on the individual cluster maps contained in Appendix B.

4.2.5 Reviewing the results of the screening identified that nine elements of critical infrastructure were located within Flood Zone 3. These consisted of seven in Flood Zone 3a and two within Flood Zone 3b. In more detail the elements were as follows:

a) Attercliffe – NG Gas Holder (Effingham Street) Flood Zone 3a

b) Blackburn Meadows – YEDL Blackburn Meadows 132 KV Sub Station (Flood Zone 3b)

c) Blackburn Meadows – YW Blackburn Meadows Sewage Pumping Station (flood Zone 3b)

d) East Stockbridge – YW Deepcar Sewage Pumping Station (Flood Zone 3a)

e) East Stockbridge – YW Stocksbridge Sewage Treatment Works (Flood Zone3a)

f) Meadowhall – YW Sheffield Road Sewage Pumping station (Flood Zone 3a)

g) Oughtibridge & Worall – YW Oughtibridge Sewage Pumping Station (Flood Zone 3a)

h) Owlerton – YEDL Neepsend 600/400KVPrimary Sub Station (Flood Zone 3a)

i) West – YEDL Stannington Road Primary Sub Station (Flood Zone 3b)

5.0 Review of Allocated Sites within Flood Risk Areas

5.1 PPS 25 states that development in Flood Zone 3 should normally be resisted although certain uses as set out in Table D2 of PPS25 may be acceptable subject to passing the sequential test and exception test.

5.2 The Sequential Test is a mechanism within PPS25 which is a risk based assessment that is applied at all stages of planning and its aim is to steer new developments to areas at the lowest probability of flooding. (i.e. Flood Zone 1). If following the application of the Sequential test, it is not possible to locate developments in areas at lower risk of flooding, then the Exception Test needs to be applied. This test provides a method of managing flood risk whilst still allowing necessary development to occur in areas outside Flood Zone 1 where some continuing development is necessary for wider sustainable development reasons, taking into account the need to avoid social or economic blight and the need for critical infrastructure to remain operational during floods. Further information on the Sequential and Exception Test can be found in para 16 -21 of PPS25.

5.3 In respect of Flood Zones 3b & 3a(i) these are areas that are subject to relatively frequent flooding and maybe subject to fast flowing and /or deep water. Very careful consideration must be given to future sustainability and safety issues within these areas and development may only be considered following application of the sequential test.

5.4 No development is permissible within Flood Zone 3b apart from water compatible uses and essential infrastructure and only then when and if the Exception Test can be passed.

5.5 When considering redevelopment of these sites it will be essential to engage with the Environment Agency to establish the outcome of the current strategic flood work they are undertaking within the Sheffield area and to identify common areas in respect of their requirements to retaining existing flood storage areas along with the implementation of any new flood protection works. By working with the Environment Agency, it may be possible to consider development of the water front sites in such a way as to maximise benefit to both parties in terms of flood management and capital investment on flood protection works.

5.6 The screening undertaken in section 3.1 identified sites as being located within Flood Zones 3a and 3a(i), and these are detailed in Table 3 contained in Appendix D. In order of preference, in respect of the guidelines set out within PPS 25, areas within Flood Zone 3a should be considered more appropriate than areas within Flood Zone 3a(i). Any development proposals for these sites must first undertake a site based Flood Risk Assessment for approval by the Environment Agency demonstrating compliance with PPS 25 and current Local Planning Policies.

6.0 Review of the Don Catchment Flood Management Plan – December 2008.

6.1 Sheffield lies at the foot of the Pennines, at the point where fast flowing rivers, such as the River Don, River Loxley, Porter Brook and the River Sheaf meet.

6.2 Sheffield is affected by flooding from a number of sources (river, sewer and surface water). Fluvial flooding is associated with the River Don, River Sheaf and Porter Brook corridors. The Don through Sheffield has numerous weirs and is often confined between retaining walls. The whole length is ageing and is likely to be subject to problems in the future. The city centre is at a risk from flooding should the current defences fail or be overtopped or the extensive systems of culverts become blocked. As a result of recent developments built on floodplains within the Sheffield area the River Don and its tributaries have been squeezed into channels and culverts across the city and this development of the floodplains leaves little space for the rivers to expand during floods and larger flood events will subsequently overwhelm the existing defences.

6.3 There are 5.7Km of man made flood defences within the Sheffield catchment area with these defences being located along the River Don, Sheaf and Porter Brook. Responsibility for these defences is split between the Environment Agency and many privately owned structures, where the riparian owners have responsibility for maintaining structures along their property boundaries.

6.4 The risk of fluvial flooding to people and property is expected to increase in the future as a result of climate change and the increasing frequency and magnitude of intense rainfall which will lead to an increase in flooding from sewers and surface water.

6.5 The Don Catchment Flood Management Plan (CFMP) which covers the Sheffield area was produced by the Environment Agency in December 2008 and provided a high level strategic plan that provides policies for sustainable flood risk management over the next 100 years. The CFMP aims amongst other elements, to achieve the following:

a) Reduce the risk of flooding and damage to people and property and the environment caused by floods
b) Maximise opportunities to work with natural processes and deliver multiple benefits from flood risk management, and make an effective contribution to sustainable development
c) Promote sustainable flood risk management
d) Inform and support planning policies, statutory land use plans and implementation of the Water Framework Directive.

6.6 The CFMP identified that at present the Sheffield area is currently generally defended to a 20 year standard of protection (5% AEP) and that there are 2639 properties at risk from flooding during a 1% AEP, of which 1601 were residential properties. Although the proportion of properties is considered low, the location of the risk is considered critical with much of the risk being located within the City Centre.

6.7 In looking forward to actions to reduce risk the CFMP will seek to adopt an integrated approach to reduce flood risk from all sources. This will require consideration of development plans and regeneration aspirations, to ensure that they are implemented in accordance with Government Guidelines (PPS25) and are appropriate to current and future issues. These actions need to be linked to effective development control within the area of Sheffield at risk from flooding and the Environment Agency intend to work in partnership with Developers to manage the risk of other sources of flooding through improvements to surface water and sewage infrastructure.

6.8 The CFMP also identified the need to reduce flooding in Sheffield as highlighted by the 2007 flood event. This is to be achieved by the Environment Agency developing a better understanding of the mechanisms of flooding within the various contributing catchments areas and implementing long term flood risk management options. This will include assessing the need for further defences, improving the standard of protection, reservoir storage and the long term removal of properties within high flood risk areas.

6.9 Due to the likely scale of development anticipated within the Sheffield area it is highly likely that development will take place in flood risk areas. It is therefore vital that the principles of PPS25 are implemented to ensure that inappropriate and socially highly vulnerable developments can be restricted.

6.10 In adopting a partnership approach, the Environment Agency will be able to set achievable expectations within Sheffield on what can be done to manage flood risk and ensure sustainable growth of the city and the region.

6.10 In general the Environment Agency adopted the following policy for the Don catchment area " *Policy 5 - Take Further Action to Reduce Flood Risk"*

6.11 To develop this strategy the Environment Agency will action the following:

a) Produce and implement a System Asset Management Plan (SAMP) to determine the most sustainable approach to managing assets and reduce the risk of flooding within Sheffield.
b) Develop a Strategic Flood Risk Management Strategy for the Sheffield area.
c) Continue to develop the Don Flood Risk Management Strategy, including consultations with stakeholders.
d) Support Sheffield City Council who are undertaking a Surface Water Management Plan (SWMP) to assess the risk of flooding from surface water within the Don catchment area.
e) Carry out a study for the Porter Brook, Blackburn Brook and River Sheaf to identify any flooding risk and better understand the surface water and flooding mechanisms associated with these rivers.
f) Determine in greater detail the risk of flooding to critical infrastructure and the consequences loss of the facility during flooding. Where practically possible ensure that these sites remain operational during flood events.

7.0 Planned Improvements to Flood Defences within the Flood Risk Areas

7.1 Following the screening process undertaken within Section 4.0 and the review of the Don Catchment Flood Management Plan, contact was made with both The Environment Agency and Sheffield City Council's Flood Section to identify what capital works or maintenance works they have programmed that will provide additional protection to the elements of critical infrastructure identified as being located within Flood Zone 3.

7.2 Environment Agency Response

7.2.1 The Environment Agency confirmed their approach is to review the available data as a part of the 'Sheffield Comprehensive Study' (SCS). When the SCS is complete strategic areas for action in terms of potential new defences (if appropriate) may be identified. However, at this point in time no specific schemes (i.e. specific flood defence projects) within the infrastructure study area have been identified to provide additional flood protection to the critical infrastructure.

7.3 Sheffield City Council Flood Section Response

7.3.1 SCC confirmed that they are commissioning a Surface Water Management Plan (as set out under the Don CFMP) which should be completed by March 2011.

7.3.2 Currently expenditure on drainage from the capital budget is approximately £100,000 per annum which is split between capital and minor projects and maintenance of highway drainage at flooding 'hotspots'. These projects consist of a combination of investigatory work (CCTV surveys) and a number of capital projects such as the improvements at Wicker, Nursery Street and at Kelham Island.

7.3.3 There is no land drainage revenue budget for site works, but the two full time, engineering land drainage staff are funded from revenue. Streetforce undertake routine revenue work on highway drainage matters such as gully cleaning.

7.3.4 In view of the scale of expenditure the flood defence projects undertaken and in planning they are unlikely to have a significant impact on critical infrastructure flood risk. As such a meeting to discuss the impact of future SCC flood defence projects on critical infrastructure is not therefore likely to identify any further information relevant to this report.

7.3.5 SCC would consider flood risk as a part of planning development control, so it is possible that some local risk reductions may be achieved through the planning process, e.g. future development around Meadowhall.

7.3.6 Sheffield CITY Council have confirmed that a strategic overview of Flood Protection is expected to be provided by the EA's Don Catchment Plan and Sheffield Strategy, both due for publication later in 2010. In the meantime a number of projects to address immediate areas of risk are under way and at various stages as follows:

1. EA River Channel clearance programme removing trees, shoals, islands and detritus under bridges to avoid future obstructions - ongoing 2009-2011.

2. Central Area Flood Protection to provide protection to the Riverside Business District
   Phase 1a (Blonk St/Wicker) on site March 2010 and due for completion July 2010
   Phase 1b (Nursery Street) start Autumn 2010 completion Spring 2011
   Phase 2 of the scheme is being developed with stakeholders and subject to funding bids.

3 Kelham island - flood walls to protect Industrial Museum - on site May 2010 and due for completion by end of 2010

4. Lower Don Valley Flood Protection - scheme being developed with stakeholders and subject to funding bids

5 Railway Station/River Porter - scheme in discussion with Environment Agency

6 Upstream Flood Storage in the Upper Don Valley - pre-feasibility study being carried out by the Environment Agency

7.3.7 The Council has stated that it cannot provide extra funding to cover any additional LLFA/SAB responsibilities, thus any extra budget is dependent on Central Government funding.

7.3.8 Virtually all the flooding in SCC in 2007 was fluvial flooding from the overtopping of main rivers; hence flood defence works or other reductions in flood risk are the responsibility of the EA as the relevant operating LDA.

8.0 Discussion of Critical Infrastructure in Relation to Flood Risk

8.1 The Pitt Review "Lessons Learnt from 2007 Floods" published in June 2008 highlighted the vulnerability of critical Infrastructure to flooding and the potential severe impacts that such flooding would have on significant areas of the country.

8.2 The review made a number of recommendations in respect of critical infrastructure, these being:

a) An assessment of assets at risk from flooding
b) In the short and longer term, to work together with infrastructure operators to build in a level of flood resilience into the relevant assets.

8.3 In respect of the first item, the Environment Agency have already identified this element and incorporated it into the Don CFMP. This study will also assist the Environment Agency and Sheffield City Council in progressing the study and data capture.

8.4 It is understood that some infrastructure operators have already commenced a review of the flood risk at each of their key sites and further discussions will be required with each operator to identify what improvement works they have planned in respect of individual sites.

8.5 As stated previously a holistic view was undertaken in respect of the screening of critical/strategic infrastructure by considering them on a cluster basis rather than per allocated site. Where it would no doubt be fair to assume that any allocated site within a cluster would be directly affected, by the failure due to flooding, of the relevant element of critical infrastructure. There will therefore be other clusters and allocated sites affected by the failure of the critical infrastructure and to gain a better understanding of the implications of this, more detailed information in relation to their catchment areas will be required.

9.0 Conclusions and Recommendations

9.1 The review of flood risk in respect of critical/strategic infrastructure has identified the following:

1 That of the 322 allocated sites, 28 No. were located within Flood Zone 3. Of these 19 No. were located within Flood Zone 3a, six were within Flood Zone 3a(i) and two within Flood Zone 3b. 46 No. were located within Flood Zone 2, with the remaining 248 allocated sites all being located within Flood Zone 1.

2 Based on the screening by clusters, nine elements of critical infrastructure were located within Flood Zone 3 of which two were located within Flood Zone 3b and the remaining elements located within Flood Zone 3a. No elements were located within Flood Zone 3a(i)

3 In respect of future development of any of the allocated sites located within Flood Zone 3, preference should be given to sites within Flood Zone 3a over Flood Zone 3a(i). No development will be allowed, except for water compatible use or essential infrastructure within Flood zone 3b. For all developments within Flood Zone 3 a site based Flood risk Assessment will be required which will need to incorporate a sequential and Exception test where required under the recommendations as set out in PPS25.

4 The Don Catchment Flood Management Plan has identified that at present the area is defended to a 5% AEP and is at continued risk from flooding, in particular the City Centre and areas along the main rivers within the city. The CFMP proposes to take further action to reduce flood risk and has identified the need to undertake further studies and preparation of action plans in order to better understand the mechanisms of flooding and to develop ways of controlling the risk of future flooding, in particular taking into consideration the impacts of climate change.

5 The CFMP also identified the need for the Environment Agency to adopt a partnership approach with potential developers to allow the Environment Agency to achieve their expectations within Sheffield on what can be done to manage flood risk and ensure sustainable growth of the city and the region. By working with the Environment Agency, it may be possible to consider development of the water front sites in such a way as to maximise benefit to both parties in terms of flood management and capital investment on flood protection works.

6 Following consultation with the Environment Agency and Sheffield City Council, Flooding Section it was identified that a strategic overview of Flood Protection within the city is expected to be provided by the Environment Agency's Don Catchment Plan and Sheffield Strategy both of which are due for publication in late 2010.

7 Other than some improvements at Wicker, Nursery Street and at Kelham Island and some ongoing maintenance works, no new capital flood protection works are programmed to be commenced in the near future by either party although several schemes are under review in conjunction with stakeholders and subject to funding bids. A review of these existing schemes, and their implications upon any critical infrastructure within the relevant cluster, will be undertaken once detailed information has been provided by Sheffield City Council. It should also be noted that both parties are involved in undertaking further studies and any planned capital flood protection works will be identified following completion of these further studies.

8 As identified through the screening process, there are certain elements of critical infrastructure i.e. primary sub stations, sewage treatment plants, gas holders and sewage pumping stations) that are at risk from flooding within the 1% AEP zone. To establish the implications of failure of these elements on the allocated sites it will be necessary to undertake a more detailed analysis of their catchment areas.

9 Within the Don CFMP it has been accepted by the Environment Agency that critical infrastructure needs to be protected during times of extreme flooding and this will be reviewed as part of their further studies.

9.2 Based on the above and the issues identified in the report, we would make the following recommendations:

1. The sequential approach as set out in PPS25 is adopted in considering the sites to be developed i.e. sites with a lower flood risk (i.e. Flood Zone 1), taking priority of sites in Flood Zone 2.

2. That in developing their strategy for the development of any waterside allocated sites located within Flood Zone 3, that Creative Sheffield ensure that priority is given to sites located within Flood Zone 3a over Flood Zone 3a(i). It is not anticipated that the development proposals will be to develop water compatible developments or essential infrastructure and therefore no development should be considered within Flood Zone 3b.

3. Any development proposals associated with development within Flood Zone 3 or 2 should include a flood risk assessment which addresses the needs for any sequential or exception test as deemed necessary by the specific nature of the development proposal.

4. All future developments should ensure compliance with PPS25 – Development and Flood Risk and aim to adopt a sustainable drainage system.

5. To incorporate the findings of this study into the findings of the main infrastructure study to review the future development of any of the allocated sites.

6. To assess the specific implications of where the nine elements of critical infrastructure were identified within Flood Zone 3, that further details are obtained from the relevant infrastructure provider to assess what flood protection or flood resilience measures have been provided ort are proposed and to identify any specific allocated sites that are vulnerable as a result of failure of the facility.

7. Establish a formal dialogue with the Environment Agency and Sheffield City Council's Flood Section to identify their programme for completion of the Surface Water Management Plan (SWMP), the Strategic Flood Management Plan (SFMP) and the System Asset Management Plan (SAMP).

8. Through this dialogue and on completion of the three studies to work in partnership with the Environment Agency and Sheffield City Council to review the implications of development of the allocated sites within Flood Zone 3. Where any flood protection works are proposed, then these to be developed in partnership with the two authorities.