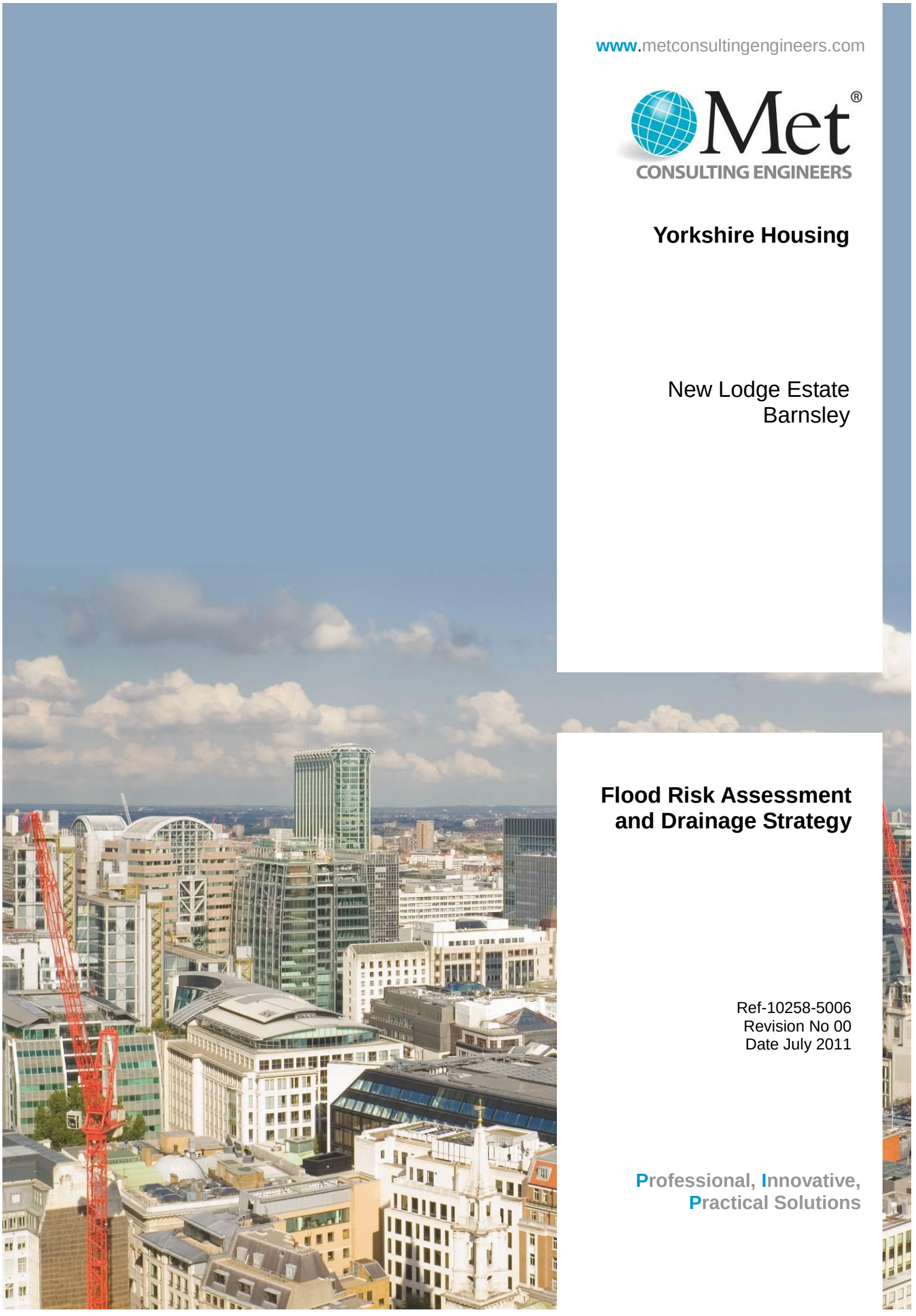


www.metconsultingengineers.com

Met® CONSULTING ENGINEERS

Yorkshire Housing

New Lodge Estate
Barnsley

Flood Risk Assessment and Drainage Strategy

Ref-10258-5006
Revision No 00
Date July 2011

Professional, **I**nnovative,
Practical Solutions

Revision Record

Revision Record Report Ref: 10258-5006 FRA					
Rev	**Description**	**Date**	**Originator**	**Checked**	**Approved**
00	Final Report	19 July 2011	ATK	RJS	BJS

This report is to be regarded as confidential to Yorkshire Housing. It is intended for your use only and may not be assigned. Consequently and in accordance with current practice, any liability to any third party in respect of the whole or any part of its contents is hereby expressly excluded. Before the report or any part of it is reproduced or referred to in any document, circular or statement and before its contents or the contents of any part of it are disclosed orally to any third party, our written approval as to the form and context of such a publication or disclosure must be obtained.

Prepared For:	**Prepared By:**
Yorkshire Housing 6 Innovation Close Heslington York YO10 5ZF	**Met Consulting Engineers** Southgate House Pontefract Road Leeds West Yorkshire LS10 1SW

Contents Page

1.0		**Introduction**	**1**
	1.1	Background	1
	1.2	Information Sources	4
	1.3	Geology	4
	1.4	Hydrogeology	4
	1.5	Hydrology	4
	1.6	Current Environment	5
	1.7	Development Proposal	6
	1.8	Historical Notes	6
2.0		**Flood Risks and Mitigation**	7
	2.1	Main River Flooding	8
	2.2	Non Main River Flooding	9
	2.3	Surface Water Drainage Related Flooding	11
	2.4	Overland Flows	11
	2.5	Groundwater Flooding	13
	2.6	Tidal Flooding	13
3.0		**Run-off Assessment**	**14**
	3.1	Existing Site	14
	3.2	Development Proposal	15
	3.3	Proposed Measures	16
4.0		**Conclusions & Recommendations**	**18**
	4.1	Conclusions	18
	4.2	Recommendations	19

Appendices

Appendix 1 Site Location
Appendix 2 Photographs
Appendix 3 Indicative Site Plan
Appendix 4 Soak-away Test Results
Appendix 5 Site Topographical Survey
Appendix 6 Indicative Flood Plain Map
Appendix 7 Existing Impermeable Areas Plan
Appendix 8 Yorkshire Water Sewer Records
Appendix 9 Yorkshire Water Sewer Records, Public and Private

1.0 Introduction

1.1 Background

i. We have been requested by Bernard Williams Associates to undertake a Drainage and Flood Risk run – off Assessment, on behalf of their client, Yorkshire Housing Association, for two parcels of land within the New Lodge Estate at Barnsley.

ii. The New Lodge Estate is under going a program of renewal and refurbishment, where areas of the estate have been demolished and replaced with new dwellings.

iii. The two areas of land under consideration are located to the East of Beverley Close and to the West of Sherburn Road and have only recently been demolished and cleared with the exception of a former pair of shops to the south of Langsett Road that forms part of the Beverley Close site.

iv. Both sites are irregular in shape, the Beverley Close site extends to 0.52 Ha, the Sherburn Road site extends to 0.75Ha located approximately 2.4 Kilometers North of Barnsley Town Centre at Grid Reference SE 3409SW and SE3408NW respectively.

v. Both sites have frontage access to the public highways of Beverley Close, Langsett Road, Sherburn Road and New Lodge Crescent and are outlined on the enclosed location plan (Appendix 1)

vi. The nearest watercourse to the site is the River Dearne approximately 660m to the South West flowing to the South East and through Barnsley Town Centre.

vii. The general fall of the Beverley Road site is to the North East by approximately 3m, The Sherburn Road site to the South East by approximately 10m.

vii Yorkshire Water drainage records shows a 150mm diameter Surface Water Sewer running along the site frontage of the Beverley Road site, crossing the Northern boundary linking to the network in Kirkstall Road. 150mm and 225mm diameter Surface Water sewers are shown in the far footpath of New Lodge Crescent, and the garden frontages to the properties on the far side of Sherburn Road flowing to the South East. (Appendix 8 attached)

ix Further examination of Yorkshire Waters database reveals the recorded routes of private combined drainage for both sites. The Beverley Close site shows two 150mm diameter drains feeding the original dwellings on the site, one adjacent the Northern boundary, and a route running through the rear gardens of the plots fronting Langsett Road and Kirkstall Road. There is very little evidence to indicate the existence of these routes on the survey. The Sherburn Road site shows foul water drains flowing in the rear gardens of the former properties on Sherburn Road and New Lodge Crescent, combining together in the South East corner before crossing under Sherburn Road into the Public Sewer. The drain running in the rear garden of the former properties on Sherburn Road also serves properties on Wensley Road, immediately North of the site, and is therefore live.(Appendix 9 Attached)

x The existing adopted drainage system and watercourse accept the general urban development and land drainage flows from the immediate area, which are as described above.

xi. The proposal is to provide new replacement residential dwellings, comprising of approximately 38 dwellings with associated parking and garden areas.

xii. The Environment Agency has powers within the planning system to comment on planning applications that require a site-specific flood risk assessment. Planning Policy Statement 25 (PPS 25) directs the response of the Environment Agency on matters of development and flood risk. The proposal site requires a flood risk assessment according to Annex E9 of PPS 25, which states all development

proposals within Low Probability (Zone 1) flood risk areas on sites greater than 1 hectare in extent require a site specific flood risk assessment. PPS 25 has further consolidated powers of the regulator to influence planning decisions with objections and conditions that are to be taken as "material consideration" in planning decisions. In respect of this proposal Annex F: Managing Surface Water is most relevant. Paragraph F.5 states the effective disposal of surface water is a material planning consideration. Contact with the EA has confirmed limiting surface water runoff from this Site will be their main issue of concern.

.

xiii. As a consequence of PPS25, issued in December 2006, which refers to Flooding and Flood Risk, it is necessary to provide an assessment of the potential problems which are associated with:

a. Permitting the Development.
b. Potential risk of flooding from the watercourse.
c. Safety of occupants of the dwellings.
d. Impact upon the local hydrological network.

xiv. In the absence of a report, the Planning Authority are required to use the ''Precautionary Principle'', which indicates to the approving authority, that they should refuse the application, unless there are grounds for not doing so.

xv. In order to provide a Flood Risk Assessment, use has been made of the information contained at the offices of the Environment Agency and also the Indicative Flood Plain Maps for the 1in100 Year Storm Event, which have been produced by the Institute of Hydrology.

xvi. The Environment Agency and Yorkshire Water have been consulted and their information and comments have been used in this report.

1.2 Information Sources:

i. The principal information sources which have been used for this Flood Risk Assessment are:

a. Geological Maps
b. Yorkshire Water – Main Drainage
c. Environment Agency – Flood Defence.
d. Barnsley Metropolitan Borough Council - Strategic Flood Risk Assessment.

ii. These have been reviewed in conjunction with an inspection of the current:

a. Geological Maps,
b. Drainage records,
c. Flood maps,
d. Visual inspection of land, existing watercourses and the surrounding area.

1.3 Geology:

The 1: 50,000 BGS Solid Geological Map indicates the site to be underlain with the Woolley Edge Rock (Sandstone, coarse grained in the North becoming finer to the South, Formation of the Pennine Middle Coal Measures formation. No superficial deposits are indicated.

1.4. Hydrogeology

The site is not within the Environment Agencies Groundwater Protection Zone.

1.5. Hydrology

The nearest Surface Water feature to the site is the River Dearne located approximately 660m to the South West.

The site is shown to be located within Flood Zone 1

1.6. Current Environment

i. The land is presently vacant and laid out to rough scrubland. It is believed that the site was demolished and cleared in late 2010, early 2011.

ii. The land is located 2.4 kilometers North of Barnsley Town centre, on the fringe of the Town.

iii. Yorkshire Water drainage records shows a 150mm diameter Surface Water Sewer running along the site frontage of the Beverley Road site, crossing the Northern boundary linking to the network in Kirkstall Road. 150mm and 225mm diameter Surface Water sewers are shown in the far footpath of New Lodge Crescent, and the garden frontages to the properties on the far side of Sherburn Road flowing to the South East. (Appendix 8 attached)

iv. Further examination of Yorkshire Waters database reveals the recorded routes of private foul water drainage for both sites. The Beverley Close site shows two 150mm diameter drains feeding the original dwellings on the site, one adjacent the Northern boundary, and a route running through the rear gardens of the plots fronting Langsett Road and Kirkstall Road. There is very little evidence to indicate the existence of these routes on the survey. The Sherburn Road site shows foul water drains flowing in the rear gardens of the former properties on Sherburn Road and New Lodge Crescent, combining together in the South East corner before crossing under Sherburn Road into the Public Sewer. The drain running in the rear garden of the former properties on Sherburn Road also serves properties on Wensley Road, immediately North of the site, and is therefore live.(Appendix 9 Attached)

v. It is apparent from a site visit that some of the existing drainage crossing the Sherburn Road site been filled with demolition rubble and as some of these drains feed existing properties on Wensley Road to the north, this is likely to become a problem. A separate camera survey has been undertaken of any

existing drainage evident around the site, and this is provided under separate cover.

vi. The delineation of the High Risk Zone within the Dearne Valley is relatively straight forward as this is well understood as a result of recent flood events and previous flood modelling projects. The Environment Agency are currently taking a strategic approach to the catchment as a whole. This comprises of the Rivers Don, Dearne and Rother. This will give an understanding of how floodwaters are generated and how these floodwaters then pass through the catchment. It also looks at how defences across the catchment act together to reduce the risk of flooding and where changes may provide greater benefits and maximise these to better use across the catchment, it is likely that the extent of Washland designation will increase as understanding of the flood regimes improve.

1.7. Development Proposals

i. The outline development proposal indicates a scheme of approximately 38 dwellings with associated access and parking. A copy of the outline proposal is attached in Appendix 3.

1.8. Historical Notes

i. As far as we are aware, the site has never flooded and has never caused flooding to other property.

ii. The Environment Agencies indicative flood plain map for this area (Appendix. 6) shows the site to be within Flood Zone 1, ie having less than a 0.1% annual probability of River Flooding in any year and there is no record of flooding at this site.

iii. The Barnsley Strategic Flood Risk Assessment also shows the site to be within Flood Zone 1, ie having less than a 0.1% annual probability of River Flooding in any year (Appendix 6)

iv. Yorkshire Waters records database (DG5 Register) shows no attendance's in the area and there are no problems reported on the main sewer network.

2.0 Flood Risks and Mitigation

i. This section describes the potential sources of flooding and their impact on the proposed development and where required, the proposed mitigation measures.

i. An established framework for environmental risk assessment that can be effectively applied to Flood Risk Assessment is the Source Pathway Receptor Model

a. Sources: The weather and other elements that can trigger flooding
b. Pathways: The mechanism's by which water generated by sources becomes flooding.
c. Receptors: The people, properties and natural environment that are affected by flooding.

ii. Four main source of flooding have been identified within the Barnsley catchment :

- Main River Flooding.
- Non Main River Flooding.
- Tidal Flooding.
- Surface Water Drainage related flooding

iii. The Pathways are in general the Rivers, drains, sewers and aquifers. High flows in the rivers drains and sewers can exceed drainage networks and high subterranean ground water levels can cause flooding from artesian pressure.

iv. The receptors to Flooding in the Barnsley catchment are people, the built environment, agricultural land, infrastructure and environmental assets. Major floods can have significant impact on these receptors.

All these flood risks are described in the sections following.

2.1 Main River Flooding

Risk

i. Flooding from rivers and other natural water courses is usually caused by prolonged and intense rainfall generating high rates of run- off which overwhelm the capacity of the river to convey the water downstream. Although unlikely, high flows can also be the result of unplanned, but sudden discharges from reservoirs.

ii. The River Dearne flows mainly East for approximately 30 Kilometres from its source in West Yorkshire, to its confluence with the River Don at Conisbrough. Barnsley and its surroundings were heavily affected by the flood events in 2007, the intense rainfall caused river levels to rise rapidly filling the Upper Dearne washland and the Lower Dearne washland downstream of Cudworth. Once these washland areas were full, there was no more space available for Flood water. The rivers level kept on rising in response to further heavy rainfall and overtopped its banks leading to flooding in Darton, Darfield, Bolton on Dearne and the South East of Barnsley.

Mitigation

iii. Since the flood events of June 2007, both the Environment Agency and Barnsley Metropolitan Borough Council have undertaken inspection and Flood alleviation work along the length of the Dearne.

i. The 100 year climate change Flood Map for this area shows the area immediately adjacent to the River in Flood. Spot levels and contours on the Ordnance Survey map indicate this area to be at a level of 46m AOD. The site sits at an elevation of 86m+ AOD and is therefore unlikely to be affected by Flood Waters from the River Dearne.

v. The drainage system will be designed to a recognised Industry Standard in a manner that will not increase contributing flows into the surrounding network. PPS25 requires that surface water from a development site should as far as possible, be managed in a sustainable manner to mimic surface water flows arising from the site prior to the proposed development, whilst reducing the flood risk to the site itself and elsewhere, taking climate change into account.

vi The Environment Agency are currently taking a holistic approach to the whole catchment and its current defences, and how these act together to reduce flooding, and where changes to the arrangement of these defences would provide greater benefits. It is clear that the site is at a natural elevation that will protect it from flooding from the River Dearne.

2.2 Non Main River Flooding

Risks

i. Ordinary Watercourses are those Rivers and Streams that are not designated Main River and are therefore the responsibility for maintenance and mitigation falls with the Local Authority. A number of the ordinary watercourses within the Barnsley District are designated Critical Ordinary Watercourses. This designation

reflects a known issue with respect to flooding, and is generally associated with limited channel capacity, channel constrictions and a poor maintenance regime.

ii. Many constructed drainage systems such as pipes, sewers, land drainages and drainage channels exist to manage run off from developments. During prolonged periods of heavy rainfall, flooding may occur if the rainfall event exceeds the capacity of the drainage system or the system becomes blocked or inefficient through lack of maintenance. Flooding will also occur if the system surcharges due to a high water level within the receiving watercourse.

Mitigation

iii. There are no Critical Ordinary Watercourses in the vicinity of the site

iv. The drainage system will be designed to a recognised industry standard in a manner that will not increase contributing flows into the adjacent network. PPS25 requires that surface water from a development site should as far as practicable be managed in a sustainable manner to mimic surface water flows arising from the site prior to the proposed development, whilst reducing the flood risk to the site itself and elsewhere taking climate change into account.

ii. Current guidance indicates that in order to take full account of the climate change event, a 20% increase in rainfall should be accommodated.

iii. Benefits may also be achieved through the use of recycling rainwater (grey water usage) and this should be considered by the end user.

2.3 Surface Water Drainage related flooding

Risk

i. Where infrastructure exists that retains, transmits or controls the flow of water, flooding may occur if there is a structural, hydraulic, geotechnical mechanical or operational failure. Because of the nature of these structures, sudden onset of flooding from these can be catastrophic.

Mitigation

ii. The Environment Agency's indicative flood plain map for this area shows the site to be within Zone 1. This zone comprises of land assessed as having a less the 1 in 1000 annual probability of river or sea flooding in any year (< 0.1%).

iii. All uses of land are appropriate in this zone.

iv. Redevelopment of the site will not contribute increased flows to the drainage network but will seek to control and reduce flows during peak storm events through surface water balancing.

v. The Strategic Flood Risk Assessment specifically looks at Sewer Flooding following the problems encountered in Barnsley during the 2007 Floods, but there are no references to this on the New Lodge Estate.

2.4 Overland Flows

Risks

i. Flooding from overland flows is caused when the intensity of rainfall exceeds the infiltration capacity of the surface onto which it falls, or when, during prolonged periods of wet weather, the soil becomes so saturated that it cannot accept any more water. Developments that include significant impermeable surfaces, such as roads, car parks and roofs, may increase the occurrence of overland flow.

ii. Overland flow will tend to occur for a similar period of time as the rainfall event that causes it, however, the flood water may remain for some time after accumulating at the surface in low areas with no significant outlet.

iii. Developments can enhance the risk of flooding from overland flows due to the increased volume of surface water run- off. In the case of the New Lodge sites the impermeable areas will be very similar to the previous use of the site and therefore run off rates will also be similar. In accordance with the guidance within PPS25 a 30% reduction in run- off rates will need to be applied with associated surface water attenuation provided to ensure that the post development catchment areas do not generate greater rates and volumes of run-off than the current situation.

Mitigation

v. Redevelopment of this site will minimise the potential of flooding through overland flows with the introduction of positive drainage systems serving the properties.

vi. As the impermeable areas of the site will remain similar, surface water run-off will also remain similar but will need to be controlled and stored to provide a 30% reduction in run off providing less of a flood risk to the site and its surroundings.

vi. In the event of a blockage or partial failure of the drainage network on the site, careful consideration of flood routing by shaping the land will need to be undertaken to ensure that surface water run off from this site does not flood adjacent property.

vii. Permeability test results indicate that the strata beneath the site tolerates infiltration rates between 31.5m/sec and 82.3m/sec, therefore flooding from overland flows is unlikely to occur.

2.5 Groundwater Flooding

Risks

i. High ground water levels can cause flooding if the water table level exceeds the natural ground level. Any significant rainfall, particularly where this occurs for a sustained period can increase ground water levels and may result in flooding. The risk of ground water flooding is considered to be greatest where areas are underlain by permeable rocks that form major aquifers.

Mitigation

ii. The nature of the catchment geology means that ground water is unlikely to be a significant issue in this catchment. Furthermore no instances of flooding from groundwater in the New Lodge Barnsley area have been identified.

iii. The 1 : 50,000 BGS Solid Geological Map indicates the site to be underlain with the Woolley Edge Rock (Sandstone, coarse grained in the North becoming finer to the South,) Formation of the Pennine Middle Coal Measures.

iv. A visual inspection of the site did not reveal any sources of groundwater from the site.

2.6 Tidal Flooding

Risks

i. Flooding to low lying land from the sea and tidal estuaries is caused by storm surges and high tides. The onset of flooding from the sea can be extremely rapid, deep fast flowing water can create extreme hazards.

Mitigation

ii. As much of the site and its surroundings are at an elevation of 86+ m AOD the risk of tidal flooding is highly unlikely.

iii. The site under consideration is at a natural elevation of at least 86m AOD and will not therefore, be at risk of Tidal Flooding.

3.0 Run-off Assessment

3.1 Existing Site

i. The two development sites total an area of approximately 1.27Ha and was formerly the site of existing residential properties which are thought to have been demolished sometime around the end of 2010, early 2011.

ii. Considering only the roof areas of the previous properties and any large hard standing areas within the site, an existing impermeable area of 3100m² can easily be justified in evaluating the original contributing flows from the site.

iii. These hard paved areas could reasonably generate a flow in the order of 28L/sec based on a 50mm rainfall event.

iv. It is clear from the Yorkshire Water record drawings that surface water from the original properties on the site drained into the public sewer network, but this

probably drained into the foul system as the private drains are designated combined. Yorkshire Water will not permit this arrangement to continue under any redevelopment proposals.

v. The redevelopment of this site will need to fully comply with the requirements of the Code for Sustainable Homes, the requirements of PPS25, Yorkshire Water, Environment Agency and the Planning Authority.

vi. The code seeks to reduce the impact of Surface Water run-off from Developments by requiring developers to prove that both rates and volumes of run-off are less than the pre-development scenario. This is a mandatory requirement of the code and full compliance is essential. Furthermore, the code stipulates that a site left vacant for more than 5 years must be considered Greenfield, and treated as such in assessing the predevelopment run off rates.

3.2 Development Proposal

i. The development proposal seeks to provide approximately 38 dwellings with associated access and parking areas.

ii. Redevelopment of the site in the manner outlined in the initial proposal attached in Fig 3 is likely to increase contributing flows when compared against that of the existing (Figure No. 7). Even if the impermeable areas were similar, improvements in drainage design are likely to carry water to the main sewers more rapidly than previously.

iii. In relation to the requirements of PPS25, the land must not generate an increase in flows as a consequence of redevelopment and therefore it will be necessary to ensure that the reuse of the site does not create flows which exceed that which exist at present.

iv. In addition to this, the Code for Sustainable Homes requires the system to be designed to cater for the 100 year event with an allowance for Climate change for the lifetime of the development. The Code also specifically states that Peak volumes and rates of discharge should not be increased above the rate historically determined for the site.

v. Current guidance indicates that an allowance of 20% should be made for the climate Change event.

3.3 Proposed Measures

i. It is recognised that in constructing the new development, a modern drainage system will be more efficient than the existing and could increase the impact on the local drainage network.

ii. As a consequence, it is intended that the surface water discharge will be attenuated by whatever means are practical and economical and sustainable.

iii. In determining the arrangements, the use of SUDS has been considered.

iv. Soakaways

The 1: 50,000 BGS Solid Geological Map indicates the site to be underlain with the Woolley Edge Rock (Sandstone, coarse grained in the North becoming finer to the South, Formation of the Pennine Middle Coal Measures formation. No superficial deposits are indicated. Permeability Tests have been undertaken and the results are attached in Fig 4 infiltration rates range between 31.5m/sec and 82.3m/sec so these should perform adequately enough.

v. Recycling

As permeability tests show that soak-aways are an option for this site, it will not be necessary to provide rainwater harvesting to meet the criteria stipulated in the Code for Sustainable Homes. Consideration should also be given to provide

properties with a rainwater collection butt to the rear of properties for use on garden areas.

4.0 Conclusions & Recommendations

4.1 Conclusions

i. South Yorkshire Housing proposes to redevelopment two Brownfield sites within the New Lodge Estate in Barnsley for residential purposes.

ii. The site lies within Zone 1 of the Environment Agencies Indicative flood plain and it is not believed that the site has flooded or caused flooding to other property. The site is at very low risk of flooding from all sources.

iii. Redevelopment of the site will create similar impermeable areas when compared to its current status.

iv. Yorkshire Water require that surface water discharges to the public sewer will be restricted to the level of run-off – i.e. same rate of discharge to that from the existing use of the site. To maintain the "status quo" in the public sewer network, any discharge of surface water from the site should take place with similar rates of flow and/or measured areas discharging to similar points of connection to that of the existing use of the site.

v. The current site drains both and foul and surface water drainage from properties through a combined drain into the foul sewer network. Yorkshire Water will not permit this situation to re-occur without first considering alternate arrangements, these being, soak-away, watercourse, Surface Water sewer, in this order of preference.

vi. Soak-away testing has been undertaken on the site and the results are attached in Appendix 4. These show that soak-aways are a viable option for the site and as this is the preferred sustainable option in terms of Yorkshire Waters requirements and The Code For Sustainable Homes, this is the preferred method of disposal of Surface Water for the site.

vii. Foul water may drain into the public Foul Sewer network in a similar manner to the current buildings on the site, it is thought that this is achievable by gravity, however the Beverley Close site may be reliant on the private system running in the rear gardens of the properties to Kirkstall Road and these look scheduled for demolition.

viii. Development of the site in the manner outlined in this report will not increase the risk of flooding to the site or the surrounding catchment upstream or downstream.

4.2 Recommendations

i. Further camera survey investigations are required on the existing Public Sewer network to substantiate the assumptions made that the existing school on the site contributed Foul and Surface water flows into the adjacent Foul and surface water sewer network.

ii. Assessment should take account of the 100 year event and Climate Change for the lifetime of the development and this currently indicates an approximate 20% increase in rainfall intensity.

iv. Soak-aways will need to be sized to adequately cater for the areas drained As the development proposal considerably reduces the areas of impermeable paving post development, balancing of Surface Water flows can be accommodated within the drainage system for the site.

v. Consideration should also be given to providing rainwater collection butts for use on garden areas.