Eskdale Drive, Jarrow

Flood Risk Assessment and Drainage Strategy

January 2017

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CONTROL SHEET

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1 INTRODUCTION

Fairhurst were appointed by South Tyneside Homes to undertake a Flood Risk Assessment (FRA) and Drainage Strategy for a proposed development in Jarrow, South Tyneside.

The aim of this FRA and Drainage Strategy report is to evaluate the current proposals with regard to flood risk and drainage, and identify potential flood risk to and from the development site. Fairhurst have carried out the following:

i. Assessment of the development potential of the site with regards to flood risk in line with the National Planning Policy Framework (NPPF) and Flood Risk and Coastal Change Planning Practice Guidance (PPG).
ii. An assessment of the surface water runoff.
iii. An assessment of the foul water flows

The proposals are for the construction of 38no. residential properties with associated access roads and car parking on 0.76ha of a mix of brownfield and greenfield land. A proposed site layout can be seen in Appendix A.

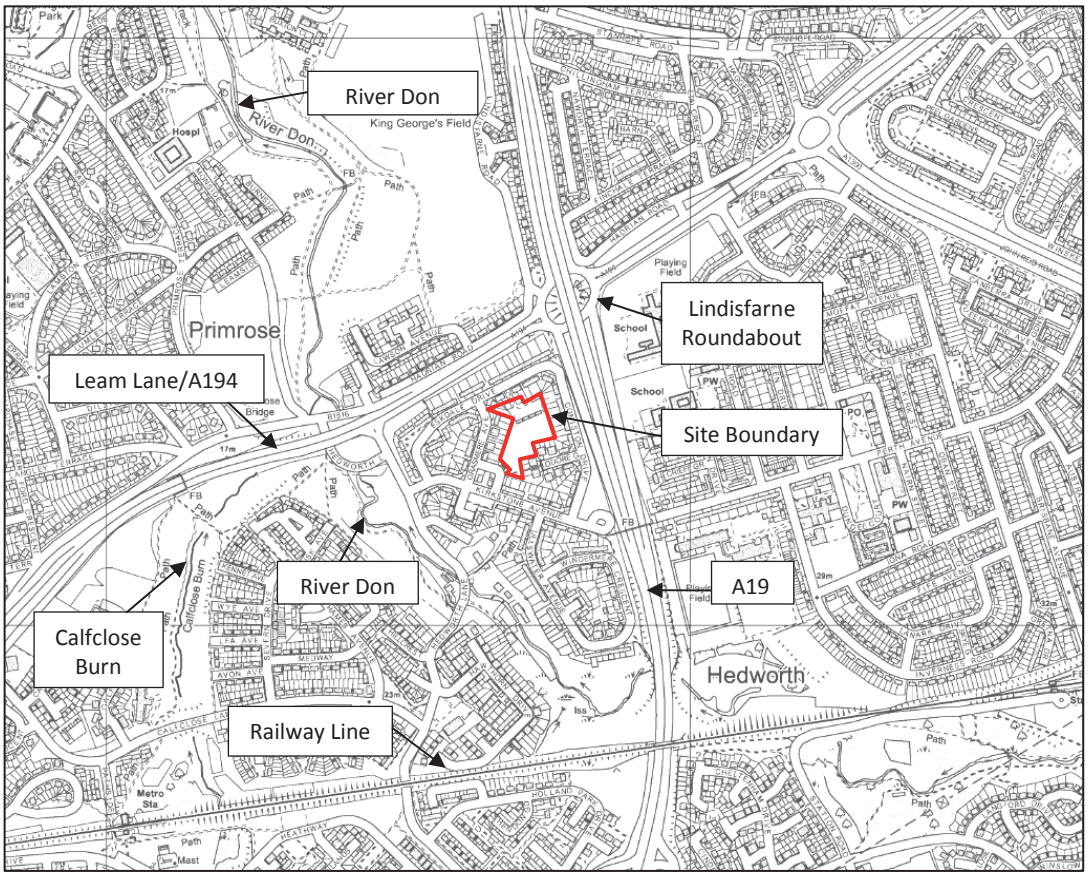


Figure 1 - Site Location and Boundary

2 LEGISLATIVE FRAMEWORK

2.1 National planning policy

One of the key aims of the National Planning Policy Framework (NPPF), Flood Risk and Coastal Change and Planning Policy Guidance (PPG) is to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.

A risk-based approach should be adopted at all levels of planning. Applying the source pathway-receptor model to planning for development in areas of flood risk requires:

- a strategic approach which avoids adding to the causes or "sources" of flood risk, by such means as avoiding inappropriate development in flood risk areas and minimising run-off from new development onto adjacent and other downstream property, and into the river systems;

- managing flood "pathways" to reduce the likelihood of flooding by ensuring that the design and location of the development maximises the use of SuDS, and takes account of its susceptibility to flooding, the performance and processes of river/coastal systems and appropriate flood defence infrastructure, and of the likely routes and storage of floodwater, and its influence on flood risk downstream; and

- reducing the adverse consequences of flooding on the "receptors" (i.e. people, property, infrastructure, habitats and statutory sites) by avoiding inappropriate development in areas at risk of flooding.

Flood risk assessment should be carried out to the appropriate degree at all levels of the planning process, to assess the risks of all forms of flooding to and from development taking climate change into account. A sequential risk-based approach should be applied to determining the suitability of land for development in flood risk areas.

In areas at risk of river or sea flooding, preference should be given to locating new development in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3. Within each Flood Zone new development should be directed to sites at the lowest probability of flooding from all sources.

Flood risk has been categorised as High, Medium and Low based on the probability of inundation. Extracts from Tables 1, 2 and 3 of the Flood Risk and Coastal Change PPG are provided below, which highlights the likely response to planning applications within each Flood Zone.

Residential development is categorised as “more vulnerable” and therefore should only take place within Flood Zones 1 or 2.

Table 1 - Extract from the Flood Risk and Coastal Change Planning Practise Guidance

Zone 1 Low Probability **Definition** This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%). **Appropriate uses** All uses of land are appropriate in this zone. **Flood risk assessment requirements** For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a flood risk assessment. This need only be brief unless the factors above or other local considerations require particular attention. **Policy aims** In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems.
Zone 2 Medium Probability **Definition** This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year. **Appropriate uses** Essential infrastructure and the water-compatible, less vulnerable and more vulnerable uses, as set out in table 2, are appropriate in this zone. The highly vulnerable uses are *only* appropriate in this zone if the Exception Test is passed. **Flood risk assessment requirements** All development proposals in this zone should be accompanied by a flood risk assessment. **Policy aims** In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.
Zone 3a High Probability **Definition** This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. **Appropriate uses** The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and

constructed to remain operational and safe for users in times of flood.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.

Zone 3a (cont.)

Policy aims
In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;
- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Zone 3b The Functional Floodplain

Definition
Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. The identification of functional floodplain should take account of local circumstances and not be defined solely on rigid probability parameters. But land which would flood with an annual probability of 1 in 20 (5%) or greater in any year, or is designed to flood in an extreme (0.1%) flood, should provide a starting point for consideration and discussions to identify the functional floodplain.

Appropriate uses
Only the water-compatible uses and the essential infrastructure listed in Table 2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows; and
- not increase flood risk elsewhere.

Essential infrastructure in this zone should pass the Exception Test.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and
- relocate existing development to land with a lower probability of flooding.

Where required an exception test must be passed in order for developments of that nature to be justified within the Flood Zone. For the Exception Test to be passed the following must be demonstrated:

a) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared.

b) the development should be on developable, previously-developed land or, if it is not there are no reasonable alternative sites on developable previously-developed land; and

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

Table 2 - Flood risk vulnerability classification from the Flood Risk and Coastal Change Planning Practise Guidance

Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines
Highly vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use3. • Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as “essential infrastructure”).
More vulnerable • Hospitals. • Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels.

- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops, financial, professional and other services,
- restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non–residential institutions not included in “more vulnerable”, and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

Water-compatible development

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

Table 3 - Flood risk vulnerability and flood zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Extract from the Flood Risk and Coastal Change Planning Practice Guidance

Key: ✓ Development is appropriate.
× Development should not be permitted.

2.2 Local Planning Policy

The current Core Strategy for South Tyneside is currently under review expected to be published winter 2018/19. The Validation of Planning Application in Tyneside published in 2016 states that Flood Risk Assessments should consider information provided in the South Tyneside Core Strategy under policies ST2, EA2 and EA5. Policy EA2 – The Coastal Zone, has been discarded for this Flood Risk Assessment as the proposed site is more than 6km inland and approximately 17m above sea level. The following strategies have been taking into consideration.

Policy ST2 – Sustainable Urban Living

High quality in sustainable urban living will be promoted by ensuring that:

A. Highest standards of urban design are promoted so that buildings and their settings make a positive contribution to the local area;

B. The use of environmentally sound and energy efficient construction materials and operational techniques are achieved and that developers work towards low carbon and zero carbon standards;

C. On-site generation of renewable energy is maximised, with a target of 10% of each scheme's energy requirements;

D. Use is made of 'sustainable urban drainage systems' and water conservation features including 'grey water recycling' and other technologies wherever possible;

E. Priority is given to alternative modes of transport to the private car, and access by:

   i. Requiring travel plans for developments which would have significant transport implications;

   ii. Enhancing electronic communication infrastructure;

F. The need to design out crime and eliminate the fear of crime has been addressed;

G. Buildings and their settings are designed to be flexible, enabling them to adapt to future needs and to take into account the needs of all users; and

H. All new development is encouraged to incorporate biodiversity and geological features at the design stage.

Policy EA5 Environmental Protection

To complement the regeneration of the Borough, the Council will control new development so that it:

A. Acts to reduce levels of pollution, environmental risk and nuisance throughout the Borough;

B. Minimises adverse impacts on the Magnesian Limestone Aquifer and its associated groundwater protection zones;

C. Focuses the treatment of contaminated and derelict land so as to achieve a balance between:

   i) the management of risk approach in its Contaminated Land Strategy; and

   ii) the regeneration of the riverside corridor;

D. Ensures that the individual and cumulative effects of development do not breach noise, hazardous substances or pollution limits; and

E. Does not permit unsustainable schemes to be located in those areas of the coast, Tyne corridor and Don Valley where flood risk is unacceptably high.

The Validation of Planning Applications in Tyneside published May 2016 also states the expected aim for the discharge rates for developments:

> *'For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.'*

'For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.'

3 DEVELOPMENT SITE

3.1 Existing Site Conditions – General Background

The proposed development site is located within The Lakes Estate which is situated east of the A19 and south of Leam Lane/A194, approximately 190m to the south west of the Lindisfarne Roundabout in South Tyneside. Jarrow town centre is located approximately 2.18km to the north east of the site and Boldon Colliery is approximately 1.7km to the south east of the proposed development.

IT is proposed to construct 30 No. dwellings on mainly greenfield land with the northern section of the site being brownfield land where current dwellings are located. The site layout is shown in Appendix A.

The access road is to the north of the site where recently a number of garages have been demolished this is currently the access point to the greenfield area. Either side of the existing access road there are areas of brownfield land.

Coniston Drive is located to the east of the proposed development with the A19 beyond. To the north of the development is Eskdale Drive with Leam Lane/A194 beyond. Kirkstone Avenue is situated to the south of the proposed development.

The approximate National Grid Reference for the site is NZ337633. The approximate postcode for the site is NE32 4AB. The proposed site covers a total area of 0.76ha of mixed brownfield and greenfield land.

3.1.1 Site Description

A topographical survey indicates that Eskdale Drive to the north of the site falls partially towards the south west and the north east. The point at which the direction of fall changes (breaks it back) is the current access to the garages. This is proposed to be the access to the site. The topographical survey (Appendix B) indicates the level at the access point to be 18.381mAOD. The road falls away from this location at a shallow gradient. The lowest point towards the south west is indicated to be 17.947mAOD and the lowest point towards the north east is indicated to be 17.780mAOD. The topographical survey also shows that the greenfield area of the site falls from east to west and towards the recently demolished garages.

3.2 Existing Watercourses

The nearest watercourse is the River Don. This watercourse is located approximately 330m to the west of the proposed development flowing in a north direction. The River Don confluences with the Calfclose Burn approximately 320m to the west of the site to the northern side of Leam Lane/A194. The River Don ultimately discharges into the River Tyne approximately 2.5km north of the site. The River Tyne ultimately discharges into the North Sea approximately 6.5km to the north east of the proposed site.

3.3 Proposed Development

The current proposals are for the construction of 38no. residential housing units with associated access roads, landscaping and car parking on 0.76ha of mixed greenfield and brownfield land.

It is proposed that the existing garages will be demolished and redeveloped and the 38 dwellings will be developed on the mixed greenfield and brownfield land.

3.4 Historic Features

Historic mapping for the area has been examined from 1873 to 1970 in order to identify changes in land use on the site and throughout the catchment which may be relevant to flood risk.

In 1873 the site and the surrounding areas are greenfield land with the River Don to the far west of the site and Leam Lane to the north. The Robin Hood Inn had been developed by 1917 to the north east of the confluence of the River Don and Calfclose Burn. Housing to the north of Leam Lane had been developed by 1941 and the estate where the proposed site is located was developed by 1958 however the A19 and Lindisfarne Roundabout was not developed until 1969. By 1970 the existing garages within the proposed development were visible and no further development has been carried out up to present day.

4 SOURCES OF FLOOD RISK INFORMATION

4.1 Environment Agency

The Environment Agency (EA) Flood Map shows the development site to be within Flood Zone 1 (Low Probability of flooding), as shown in Figure 2. This is outside of the area which is at risk from extreme fluvial or tidal flooding. The site is therefore not at risk from inundation in a 1 in 1000 year event or 0.1% Annual Exceedance Probability event (AEP) or events with a 1% AEP (1 in 100 year).

Figure 2 - Environment Agency Flood Map

= Flooding from river or sea without defences during a 1 in 100 year event.

= Additional flooding during an extreme event (1 in 1000 year event)

= Location of development

The online maps also show no areas at risk of surface water flooding within the site boundary (Figure 3). However Eskdale Drive is shown to have a medium risk of surface water flooding towards the east. This area is shown to be contained within the road and is likely to be a low point along the road where surface water may pond. There is also an area identified to the north east of Eskdale Drive where Eskdale Drive and Coniston Drive meet which is shown to have a low risk of surface water flooding. The topographical survey shows

that Coniston Drive falls towards Eskdale Drive and identifies a low point at this location where surface water could potentially pond. In this case the surface water could be picked up by drainage within the highways and may not lead to isolated surface water flooding.

A third area of surface water flood risk is to the north east of the site boundary and is located within the gardens of the existing properties towards the north east end of Eskdale Drive. The surface water flooding that is shown at all three locations could be an anomaly in the Digital Elevation Model. The Digital Elevation Model is used to identify low lying ground and indicate that it is at risk of flooding, it does not take into account any other features such as roads and other developments which could affect the route and depth of ponding water.

Figure 3 - Extract from Environment Agency surface water flood map

4.2 Strategic Flood Risk Assessment

The South Tyneside Council (STC) Level 1 and 2 Strategic Flood Risk Assessment (SFRA) was published in February 2011. The SFRA has been examined and confirms the site to be within Flood Zone 1 (Figure 4).

Figure 4 - Extract from STC SFRA confirming the site is within Flood Zone 1

The SFRA provides details specific to the development site in relation to the risk from surface water flooding. However, the exact extent of this flooding is unclear due to the image within the SFRA report being pixelated, Figure 5. The online mapping available from the EA shows a clearer image and surface water flooding is discussed in Section 4.1.

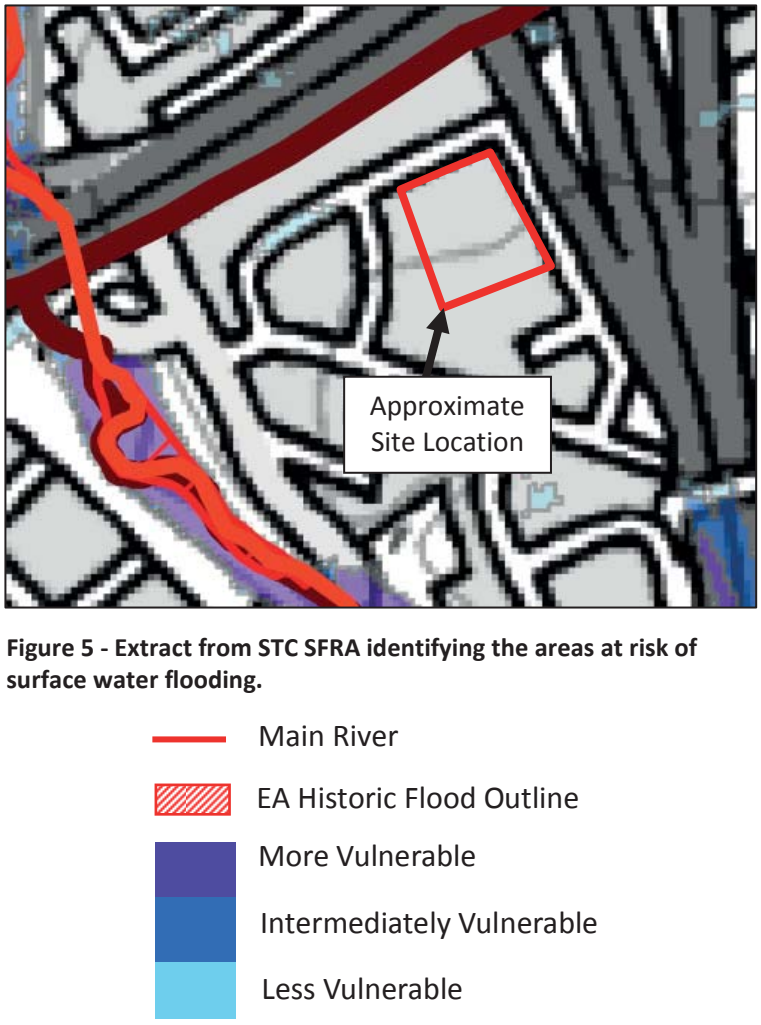


Figure 5 - Extract from STC SFRA identifying the areas at risk of surface water flooding.

4.3 Surface Water Management Plan

South Tyneside's Surface Water Management Plan (SWMP) was published in April 2014. The report has been examined and found not to include any site specific details. However comment was made in Table 3 of the SWMP with relation to flooding at Lindisfarne Roundabout:

Table 4 – Extract from Table 3 of the SWMP, Areas considered and taken forward for detailed assessment.

Area	Summary	Detailed Assessment?
Hedworth	Located between Leam Lane (A194) and the A19 around the River Don. The intermediate modelling results had not matched the suggestions of flood issues from residents during a site visit. However the partners were not aware of historical flooding in the area and it was recommended this area was not taken to detailed assessment within the scope of the SWMP.	Not taken to Detailed Assessment

4.4 Water Company

Northumbrian Water (NW), the sewerage operator in the region, is required by OFWAT to maintain a register of flooding incidents due to hydraulic capacity problems on the sewerage network. The DG5 register is a record of locations where customers have reported flooding from the sewerage network due to hydraulic capacity problems. Properties are placed on the register following investigations to determine the cause and risk of flooding. Properties are then placed on the appropriate register depending on the risk - not the number of occurrences of flooding.

NW has been contacted and confirms that there have been no sewer flooding incidents in the vicinity of the site. A copy of their response can be found in Appendix C. The area to the immediate south (Kirkstone Avenue, Windermere Cresent and Ullswater Avenue), are identified as at risk of sewer flooding. However, drainage from the proposed development is likely to flow north west into the Don Valley Trunk Sewer and is therefore unlikely to impact on existing sewer flooding.

4.5 Local Authority

The Local Authority for Jarrow is South Tyneside Council (STC). The SuDS Officer for STC has been contacted to enquire about historic flooding at the development site. They have no records of historic flooding onsite.

A copy of the response can be seen in Appendix D.

5 POTENTIAL SOURCES OF FLOOD RISK

5.1 Fluvial

Extreme fluvial flood events have the potential to cause rapid inundation of properties whilst posing a threat to the welfare of occupants and potentially preventing emergency access to properties and essential infrastructure.

There are no open watercourses within the development site, and the EA Flood Maps show the site not to be at risk of inundation from the River Don to the west of the site (see Figure 2), the site is therefore not considered to be at risk of fluvial flooding.

5.2 Infrastructure Failure

The failure of conveyance infrastructure such as culverts or bridges could increase the risk of flooding at the site.

There are no culverts within the site boundary therefore there is no risk of inundation of flows from blocked or collapsed culverts. There are no bridges within the vicinity of the site which could pose a risk to the development.

There are two culverts which convey flows of both the River Don and the Calfclose Burn beneath Leam Lane/A194 approximately 300m and 440m to the north west of the site. If these culverts were to become blocked then flows would back up and spill onto the fields to the south of Leam Lane/A194. The Calfclose Burn is approximately 9m lower than the proposed site and it is unlikely that flood waters would reach this level. Flood waters from the River Don would also not impact the proposed development as the site is approximately at a 10m higher elevation than the River Don.

5.3 Overland Flow

During periods of prolonged rainfall events and sudden intense downpours, overland flow from adjacent higher ground may ‘pond’ in low-lying areas of land (without draining into watercourses, surface water drainage systems or the ground). One of the main issues with this type of flooding is that in areas which have not reportedly flooded in the past, relatively small changes to hard surfacing and surface gradients can cause flooding (i.e. garden loss and reuse of brownfield sites). As a result, continuing development could mean that pluvial/surface water flooding becomes more frequent.

The land to the north of the site falls away from the site boundary towards Leam Lane/A194 and Jarrow Cemetery. Similarly to the east and west of the site the land falls away from the site. The land to the south of the site falls towards the site boundary; however any surface water runoff from this direction is anticipated to be captured in the existing highway and roof drainage within the existing development to the south. Therefore it is not expected to impact the proposed development.

5.4 Sewer Flooding

Within the existing access road to the proposed development there is a Northumbrian Water adopted combined sewer. The NW sewer plans show this combined sewer 'to be abandoned'. There are no other sewers shown in the proposed site. The sewer plans from Northumbrian Water are attached in Appendix E. Flooding directly from surcharging sewers does pose a risk to the proposed development.

Finished floor levels will be designed so that if any proposed sewers were to surcharge, flows would be retained within the highways within the site and directed away from the proposed dwellings. Therefore flooding from surcharging sewers is considered to be low.

6 SURFACE WATER DRAINAGE

The Flood Risk Assessment also focuses on the management of surface water to ensure flood risk is not increased elsewhere. The surface water strategy for the site will be developed in accordance with The Building Regulations Part H.

6.1 Existing Surface Water Runoff

The site covers a total area of approximately 0.76ha and is a mixture of greenfield and brownfield land.

The Tyneside Validation Checklist states that surface water runoff for greenfield land must remain at greenfield runoff rates post development. Brownfield sites when redeveloped must attempted to get as close as practicable to greenfield rates, '*For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.'

Greenfield Runoff Rates

The EA/DEFRA R&D Technical Report W5-074 'Preliminary Rainfall Runoff Management for Developments' states that for developments which are less than 50ha in size the Institute of Hydrology Report 124 (IH124) 'Flood Estimation for Small Catchments' should be used to calculate the peak greenfield runoff rates. This advice is replicated in The SUDS Manual (CIRIA C753).

The IH124 method uses the following equation to calculate greenfield runoff:

$$Q_{BAR,\ rural} = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$$

Where:
$Q_{BAR,\ rural}$ = Mean Annual Flood (m^3/s)
AREA = Catchment Area (km^2)
SAAR = Standard Average Annual Rainfall (mm)
SOIL = Soil Index (from Wallingford Procedure Winter Rainfall Acceptance (WRAP) maps)

Technical Report W5-074 states that "Where developments are smaller than 50ha the analysis for determining the peak greenfield discharge rate should use 50ha in the formula and linearly interpolate the flow rate value based on the ratio of the development to 50 ha."

The greenfield runoff rate has been calculated on a 'per hectare' basis for a range of return periods. Table 5 summarises the results and the full calculations can be seen in Appendix F.

Table 5 – Greenfield runoff rates

Event	Greenfield Runoff Rate (l/s/ha)
1 in 1 year	1.42
Q_{BAR}	1.67
1 in 30 year	2.91
1 in 100 year	3.47

6.2 Proposed Surface Water Drainage

6.2.1 Principles

The Building Regulations Part H sets out a hierarchy for the choice of discharge point for a rainwater system. In order of priority, the possibilities are given as:

- an adequate soakaway or some other adequate infiltration system; or where that is not reasonably practicable,
- a watercourse; or where that is not reasonably practicable,
- a sewer.

A review of the Soilscapes website indicated that the superficial deposits are '*Slowly permeable seasonally wet acid loamy and clayey soils'*. Drainage is classified as '*impeded drainage'*; therefore it is likely that the ground water levels will be shallow. Any soakaway or infiltration drainage system could therefore be surcharged, rendering them ineffective.

Subject to a full ground investigation to determine the infiltration rates and seasonal variability of the groundwater level at the proposed development site, it is anticipated that surface water drainage through the use of soakaways will be discarded.

Discharge into the nearest watercourse, River Don, is considered impracticable. This is due to a number of constraints:

1 - The existing services/sewers within the highways would make it extremely difficult to lay additional pipework.

2 – The River Don is approximately 330m to the west of the site.

3 – Pipework would have to be laid over 3rd party land.

The remaining option is to discharge to a sewer; the only sewer within the site is a combined sewer. It is anticipated that the existing site currently discharges to the combined sewers and by attenuating the proposed site to mimic greenfield runoff rates this will create betterment to the site post development.

Existing runoff rates have been calculated in accordance with the EA/DEFRA R&D Technical Report W5-074 'Preliminary Rainfall Runoff Management for Developments'; calculations can be seen in Appendix F.

The impermeable area for the proposed site post development has been calculated to be 0.53ha and Table 6 summarises the allowable discharge rates.

Table 6 – Allowable discharge rates.

Event	Allowable Discharge Rate (l/s)
1 in 1 year	0.75
Q_{BAR}	0.89
1 in 30 year	1.54
1 in 100 year	1.84

As shown Table 6, the discharge rates from the proposed development should be limited to 1.54l/s for all events up to 1 in 30 years and 1.84l/s for all events up to the 1 in 100 years. However, it is not practicable to achieve a discharge rate of 1.84l/s using conventional flow control techniques. Therefore discharge rates will be limited to 5l/s, the minimum discharge rate which can be reliably achieved without the risk of frequent blockages and surcharging. South Tyneside Council have been contacted and they have confirmed that a discharge rate of 5l/s is acceptable for the proposed site.

The indicative drainage layout for the proposed site can be seen on the Fairhurst drawing 112153/2001 - Indicative Drainage Layout (Appendix G). Northumbrian Water has been contacted through a Pre Development Enquiry to confirm that surface water flows can discharge into the combined sewer at 5l/s.

6.3 Surface Water Storage

To ensure that there is no increase in flood risk off site as a result of the proposed development, the discharge rates for proposed site will be limited to 5l/s for all events up to the 1 in 100 year with a 20% allowance for climate change.

To ensure that the proposed discharge rates can be achieved, it will be necessary to provide surface water attenuation within the development. The Environment Agency generally advises that a lifespan of 100 years should be used for residential developments. The Technical Guidance from the NPPF states that for the time period 2081 to 2115, peak rainfall intensity should be increased by 20% to account for the possible impacts of climate change. Taking in to account the lifespan of the development and the anticipated increase in rainfall intensity due to climate change, a surface water attenuation volume for the development has been calculated using the industry standard software, Micro Drainage.

On the basis that the proposed site will result in the creation of 0.53ha of impermeable surfaces, approximately 327m³ of storage will be required for events up to the 1 in 100 year return period with 20% increase in rainfall due to climate change (Appendix H).

The latest Technical Guidance from the NPPF also states that new developments should consider the flooding implications for the effect of a 40% increased in the peak rainfall intensity. If these implications are significant and could potentially impact the development site, another site or put people at risk, then measures would need to be implemented to

provide more attenuation for up to 40% climate change, or provide additional mitigation allowances. For example; a higher freeboard to dwelling floor levels or SuDS features to ensure that there is no risk to the site or offsite developments for the extreme 40% climate change scenario. This will be considered at the detail design stage.

6.4 SuDS

The SuDS Manual (CIRIA C753) details a wide range of drainage techniques some of which may be incorporated within the proposed drainage design. Some which may still be suitable for this site include:

- permeable paving
- geo-cellular storage;

SuDS will be incorporated into the proposed site to attenuate and store surface water runoff. Permeable paving could be incorporated in the driveways of the development and geo-cellular could be incorporated into the hard standing larger areas.

All SuDS installed will attenuate and store surface water runoff from the proposed development prior to discharging into the NW sewer. SuDS which allow the surface water to infiltrate into the ground water will not be applicable as explained in Section 4.2.

Permeable paving, with a depth of 0.5m and a void ratio of 30% could be installed, to provide approximately 105m³ of surface water storage. The remaining volume required could be stored in geo-cellular storage of approximately 1m depth, located within 3 areas of hard standing. The location of the SuDS can be seen on the Fairhurst Drawing 112153/2001 - Indicative Drainage Layout (Appendix G).

The feasibility and suitability of the SuDS solution will be fully appraised at the detailed design stage of the development. It is considered that the information provided demonstrates that a feasible solution is available. This will ensure that flood risk will not increase on, or off, site as a result of the proposed development.

7 FOUL WATER DRAINAGE

Foul flows from the proposed development are calculated to be 1.76l/s, using the design flow of 4000litres/dwelling/day in accordance with Sewers for Adoption 7th Edition.

Northumbrian Water have been contacted through a Pre Development Enquiry to confirm that foul flows can discharge at 1.76l/s into the 300mm diameter combined sewer in Eskdale Drive via a number of manholes. A copy of their response will be forwarded on receipt.

8 DEVELOPMENT POTENTIAL

The proposed development is within Flood Zone 1 (Low Probability). No detailed sequential test is therefore required to identify sites of lower risk. This is in line with the information set out in the Flood Risk and Coastal Change Planning Practice Guidance.

The proposed residential development can be classified as “More Vulnerable” according to Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance. From Table 3 in the Practice Guidance, the proposed development is suitable for this site, therefore the Sequential Test is considered to be satisfied and no Exception Test is required.

9 CONCLUSIONS

The Flood Risk Assessment and Drainage Strategy assessment for the proposed housing development at Eskdale Drive has been prepared in accordance with the NPPF and the Flood Risk and Coastal Change Planning Practice Guidance.

The development site is not within the Environment Agency's indicative flood envelopes and is classed as being within Flood Zone 1. Based on the compatibility of developments within each Flood Zone, set out within the Planning Practice Guidance, the site is suitable for the proposed development.

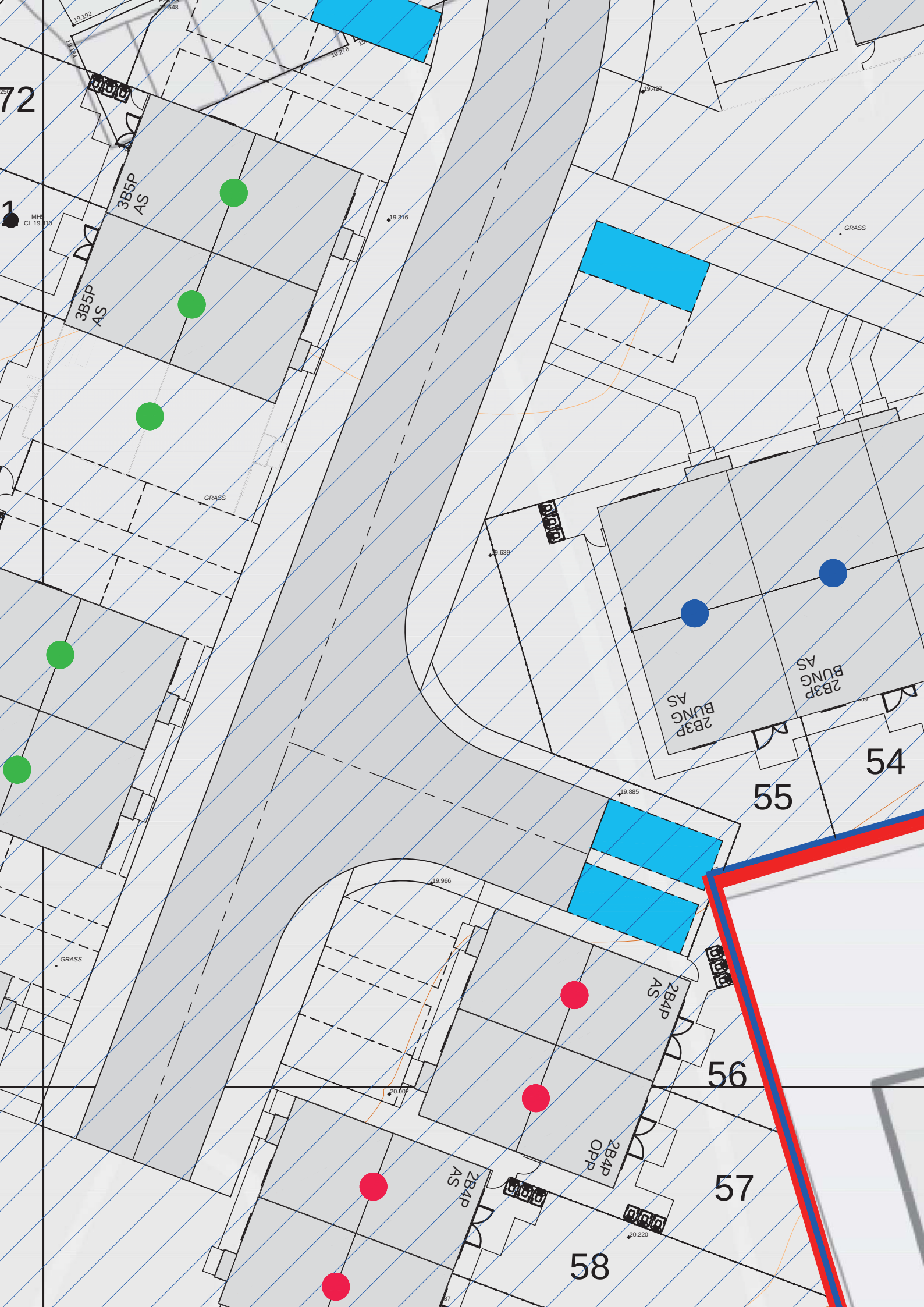
It is anticipated that surface water runoff from the site currently discharges into the existing Northumbrian Water combined sewer within the highways throughout the site. The increased runoff from the introduction of impermeable surfaces will be discharged via SuDS into the combined sewer. However, the discharge rate into the combined sewer will be reduced to greenfield runoff rates in accordance with the Validation of Planning Application in Tyneside requirements. Runoff rates below 5l/s are not practicable to achieve therefore surface water discharge will be attenuated on site to 5l/s up to the 1 in 100 year rate to ensure no increase in flood risk.

327m^3 of storage will be required to attenuate and store surface water prior to discharge into the combined sewer. SuDS which are proposed for this site are permeable paving and geo-cellular storage. The possible effects of climate change have been considered by acknowledging the requirement to make an allowance for increased rainfall in the calculation of the surface water discharge rate over the lifespan of the development in line with NPPF. The above storage volume allows for a 20% increase in climate change although a 40% increase will need to be considered at the detail design stage in accordance with the Validation of Planning Application in Tyneside requirements to ensure that the proposed development does not adversely impact on flood risk elsewhere. Design of the SuDS will be subject to a full ground investigation and groundwater monitoring results.

The site should be developed to ensure that overland flows are contained within their current location and do not adversely affect the proposed dwellings. Flooding from surface water runoff can be deemed as low risk as long as provision is made within the development proposals to accommodate existing overland flow paths.

Appendix A

Site Layout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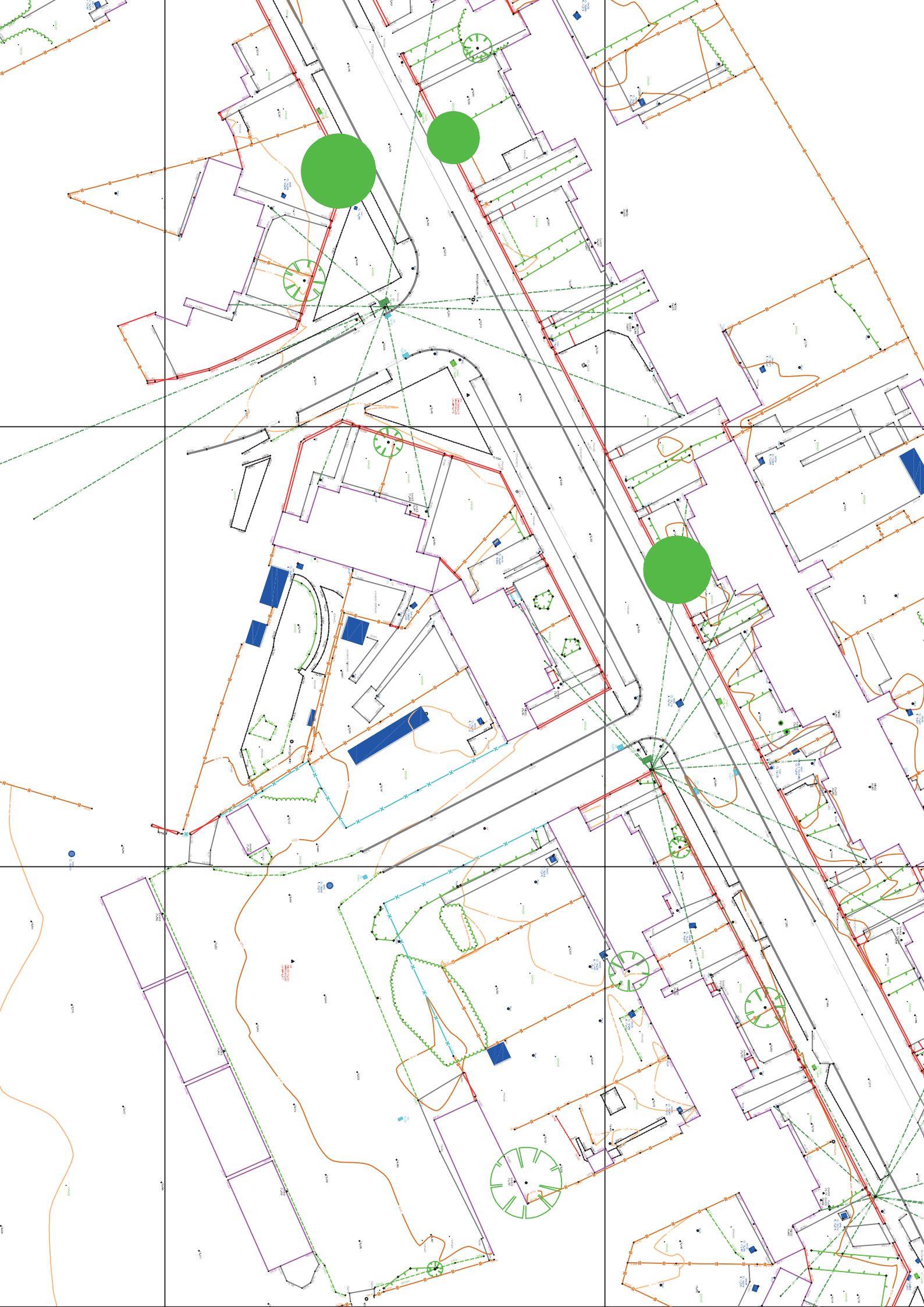
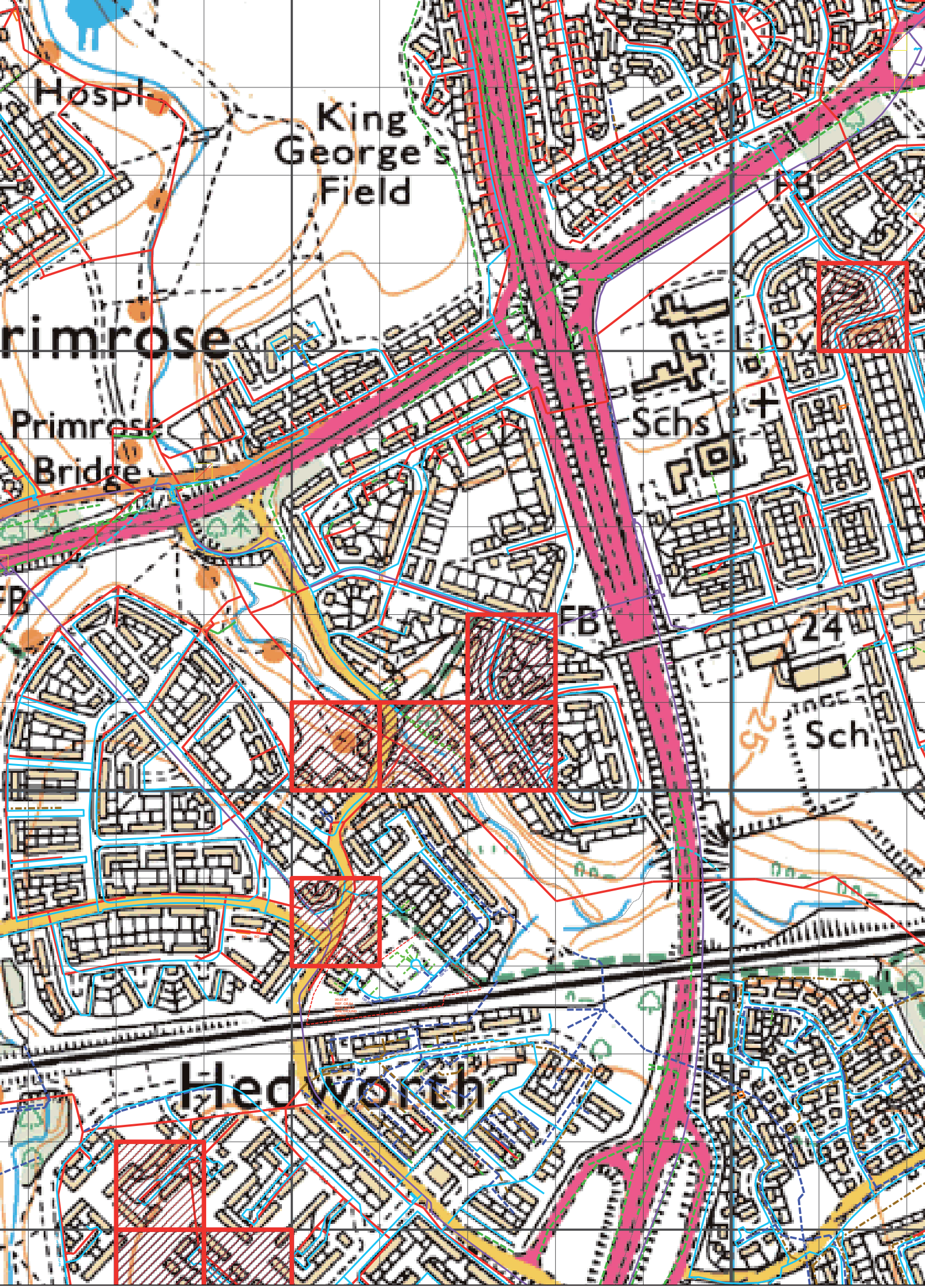
Appendix B

Topographical Survey



Appendix C

Northumbrian Water Response – DG5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Appendix D

Northumberland County Council Response – Historic Flooding

Jenny Cook

From: Michelle Hogg <Michelle.Hogg@southtyneside.gov.uk>
Sent: 12 January 2017 15:39
To: Jenny Cook
Subject: RE: 112153 - Jarrow - Historic Flooding [NOT PROTECTIVELY MARKED]

Follow Up Flag: Follow up
Flag Status: Flagged

This email has been classified as: NOT PROTECTIVELY MARKED

Hello Jenny

Yes we are good here. I have checked the records for Eskdale drive and we have no historic flooding incidents recorded.

I hope this helps

Thanks

Michelle

Michelle Hogg
Environmental Protection Officer
Environmental Health and Resilience Team
South Tyneside Council
Town Hall and Civic Offices
Westoe Road
South Shields
NE33 2RL

Tel: 0191 424 7651
Fax: 0191 424 7930
Email: michelle.hogg@southtyneside.gov.uk

From: Jenny Cook [mailto:jenny.cook@fairhurst.co.uk]
Sent: 11 January 2017 09:54
To: Michelle Hogg
Cc: Tony Hanson
Subject: 112153 - Jarrow - Historic Flooding

Hi Michelle,

Hope you and your team are well!

I write with regards to a proposed development in Jarrow, South Tyneside. We are currently writing a Flood Risk Assessment for the site and would like to know if STC are aware of any historic flooding issues on site.
The site details are as follows:

The Lakes Estate
Eskdale Drive
Jarrow

South Tyneside
NE32 4AD
OS
X: 433719
Y: 563356

LR: NZ337633

The location of the site is also indicated by the red line boundary on the attached plan.

Kind regards

Jenny

Jenny Cook
Graduate Engineer

FAIRHURST
engineering solutions, delivering results

1 Arngrove Court,
Barrack Road,
Newcastle upon Tyne, NE4 6DB
Tel: 0191 221 0505
Email: jenny.cook@fairhurst.co.uk Website: www.fairhurst.co.uk

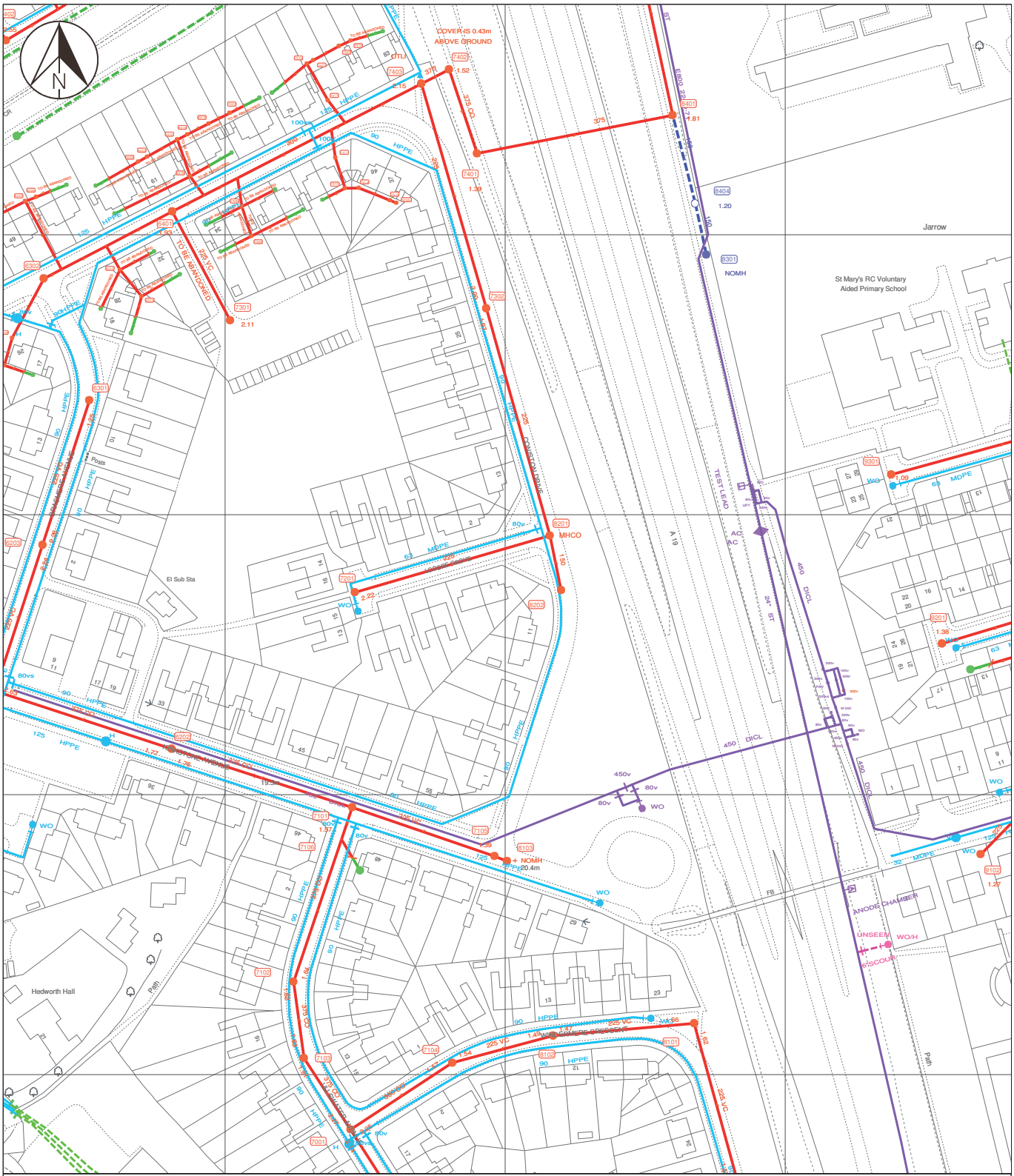
RICS NE Award Winners 2014 – Commercial
LABC NE Awards Winners 2014 - Commercial
CECA NE Project of the Decade Award Winners 2013
RTPI NE Award Winners 2013 - Urban Design

Consider the environment. Please don't print this e-mail unless you really need to.

South Tyneside Council, Town Hall & Civic Offices, Westoe Road, South Shields, Tyne & Wear, NE33 2RL, Tel: 0191 427 1717, Website: www.southtyneside.gov.uk

Appendix E

Northumbrian Water – Sewer Plans



Waste Water - NWL Responsibility	Private/Non NWL	Proposed	Water Network - Network Types	
Combined	Combined	Combined	Distribution	AB Asbestos
Foul	Foul	Foul	Treated	Abandoned
Surface	Surface	Surface	Raw	Out of Comm
Treated Eff	Trade Eff		Fire	
Untreated Eff	Watercourse		Supply	
Overflow			Private	

NORTHUMBRIAN WATER *living water*

User : CAPEL

Date : 13/01/2017 13:38:51

Title :

Map Sheet : NZ3363SE

Centre Point : 433801,563273

Paper / Scale : A4@1:2000

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Appendix F

Surface Water Runoff Calculations

The EA/DEFRA R&D Technical Report W5-074 'Preliminary Rainfall Runoff Management for Developments' states that for developments which are less than 200 ha in size the Institute of Hydrology Report 124 (IH124) 'Flood Estimation for Small Catchments' should be used to calculate the peak greenfield runoff rates.

The areas being considered are all less than 50 ha; Technical Report W5-074 provides the following advice for this scenario.

> *"Where developments are smaller than 50 ha the analysis for determining the peak greenfield discharge rate should use 50 ha in the formula and linearly interpolate the flow rate value based on the ratio of the development to 50 ha."*

This advice is replicated in The SUDS Manual (CIRIA C697).

As described above, the IH124 method uses the following equation to calculate the existing greenfield runoff:

$$Q_{BAR,\ rural} = 0.00108 * AREA^{0.89} * SAAR^{1.17} * SOIL^{2.17}$$

Where: $Q_{BAR,\ rural}$ = Mean Annual Flood (m^3/s)
AREA = Catchment Area (km^2)
SAAR = Standard Average Annual Rainfall (mm)
SOIL = Soil Index (from Wallingford Procedure maps)

For the area of South Tyneside, the SAAR is taken to be 650mm and the SOIL value is 0.3. The site area is 0.76ha, and 0.53ha of this site is anticipated to become impermeable as a result of the development. Regional Growth Factors have been obtained from Technical Report W5-074, which have been used to determine peak flows for a range of return periods.

For 50 ha $Q_{BAR,\ rural} = 0.00108 * 0.50^{0.89} * 650^{1.17} * 0.3^{2.17}$
$= 0.083554 m^3/s$
$= 83.554 l/s$

For 1.0 ha $Q_{BAR,\ rural} = 83.554/50 = 1.67 l/s/ha$

For 0.53 ha $Q_{BAR,\ rural} = 1.67*0.53 = 1.72 l/s$

Event	Growth Factor	Greenfield Runoff Rate (l/s/ha)	Allowable Discharge Rate (0.53ha) (l/s)
1 in 1 year	0.85	1.42	0.75
Mean Annual Flood	1.00	1.67	0.89
1 in 30 year	1.74	2.91	1.54
1 in 100 year	2.08	3.47	1.84

Appendix G

Fairhurst Drawing 112153/2001 - Indicative Drainage Layout


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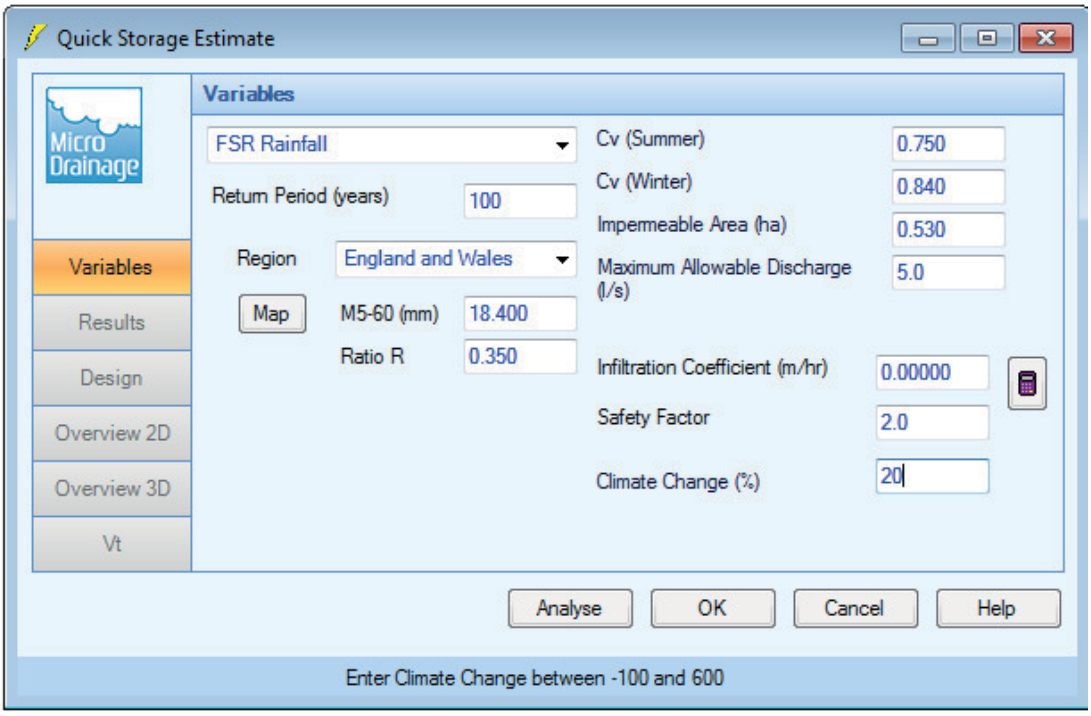
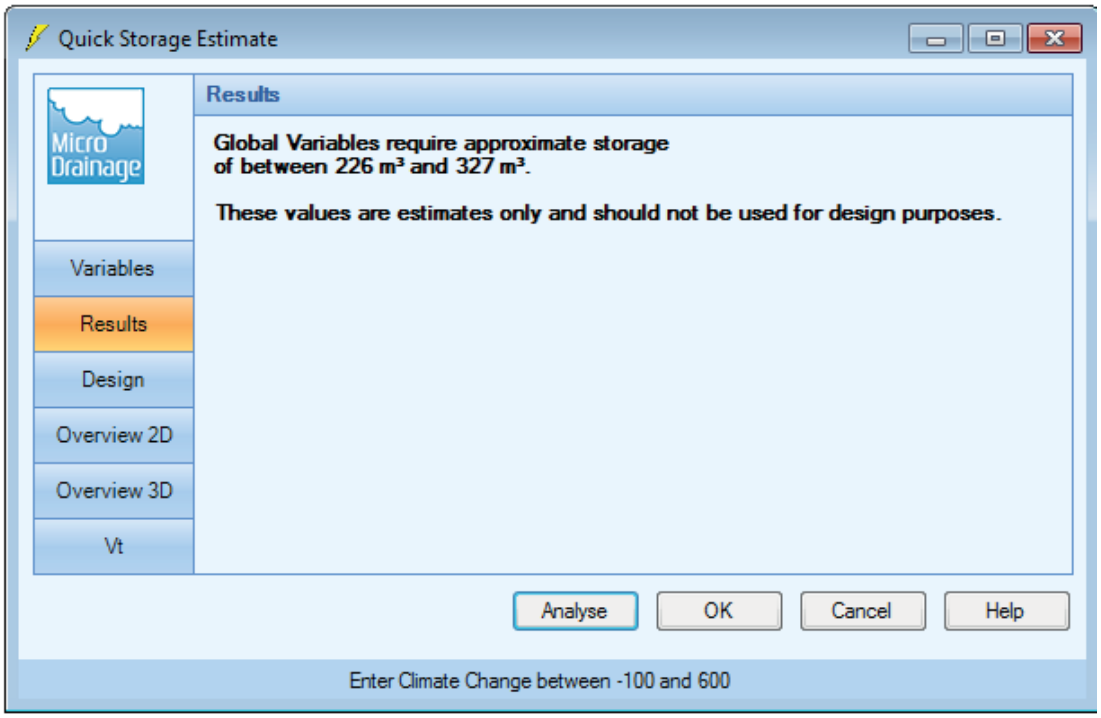
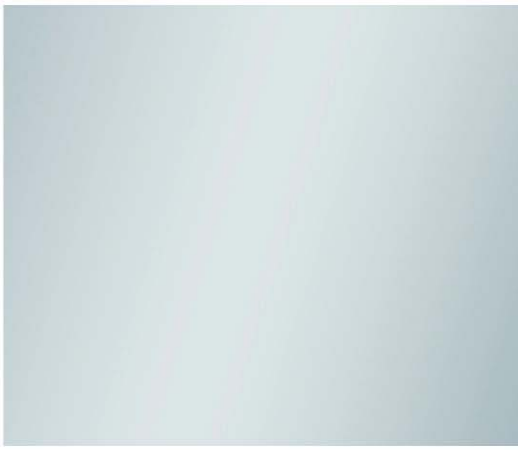
Appendix H
Micro Drainage Calculations







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