CWA
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FLOOD RISK ASSESSMENT

MEADOWS SCHOOL
BIDDULPH

CWA-15-228

SEPTEMBER 2015

Revision A

06.10.15

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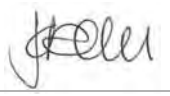
Authorised by:	
Signed:	
Dated: **Revision A**	**SEP 15** **06.10.15**

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APPENDICES

1.00 INTRODUCTION

1.01 CWA were commissioned by Wrekin Housing Trust to prepare a Level 1 Flood Risk Assessment for the Planning Application at Land off Tunstall Road, Knyspersley, Stoke on Trent, ST8 7AA.

1.02 The Flood Risk Assessment will be part of a Planning Application to be made to Staffordshire County Council.

1.03 The development proposes the construction of Extra Care Home, parking, access, landscaped area and gardens.

1.04 The development lies entirely within Flood Zone 1 where there is a low probability of fluvial flooding occurring.

1.05 This Flood Risk Assessment follows government and local guidance on development and flood risk (National Planning Policy Framework NPPF) and is undertaken in consultation with the relevant bodies.

It is a requirement for development applications to consider the potential risk of flooding to the proposed development over its expected lifetime and any possible impacts on flood risk elsewhere in terms of its effects on flood flows and run off.

The following aspects of flood risk should be addressed in all planning applications in flood risk areas:

- The area liable to flooding.
- The probability of flooding occurring now and over time.
- The extent and standard of existing flood defences and their effectiveness over time.
- The rates of flow likely to be involved.
- The likelihood of impacts to other areas, properties and habitats.
- The effects of climate change which currently requires designs to include 1 in 100 year rainfall events + 30% climate change allowance.
- The nature and current expected lifetime of the development proposed and the extent to which it is designed to deal with flood risk.

2.00 SITE LOCATION AND DESCRIPTION

2.01 The development site is situated on land off Tunstall Road, Knyspersley, Stoke on Trent, ST8 7AA, approximately 8.5km North of the centre of Stoke on Trent. The Ordnance survey National Grid reference to the centre of the site is E388041, N356965.

2.02 The site is an 'L' shape and occupies a total area of 0.9552 Ha.

2.03 The copy of the site location plan can be found in Appendix 1.

2.04 The site can be classes as a Brownfield approximately 70% is hardstanding.

2.05 The site was formerly Meadow school which consists of the main school building, two points of access, hardstanding play areas, out buildings and landscaped areas.

2.06 The neighbouring land use is as follows:

To the North - Arable agricultural land.

To the East - Residential properties fronting St Johns Road.

To the South - Junior High School and Commercial Properties.

To the West - Arable agricultural land and the 'National Route 55'.

2.07 Access to the site will be via Tunstall Road to the North-East of the site.

2.08 The site is an 'L' shape and occupies 0.9552 ha.

2.09 The site has a fall from the East towards the West of approximately 4.1m which equates to an approximate gradient of 1 in 33.

2.10 Due to the existing nature of this site it will be classed as “Brownfield Site”.

2.11 A Topographical Survey can be found in Appendix 2.

3.00 SITE DEVELOPMENT PROPOSALS

3.01 At the time of writing the report the proposals are as follows:

- An Extra Care Home consisting of approximately 70 units.
- Provisions are provided for access roads.
- 25 car spaces for extra care and 12 car spaces for the community facility.
- Gardens and landscaped areas.
- 2 points of access.

3.02 A copy of the development proposals can be found in Appendix 3.

4.00 EXISTING DRAINAGE

4.01 United Utilities Limited has been contacted for information regarding existing public foul and surface water sewers.

4.02 A copy of the United Utilities sewer records can be found in Appendix 4.

4.03 Private Drainage

4.03.01 The site is Brownfield site and from the topographical survey we can conclude that the existing building is served by both foul and storm private drainage system.

4.04 Public Foul Water Drainage

4.04.01 United Utilities Limited sewer records indicate a 150 diameter foul sewer running across the site from Tunstall Road to the West boundary of the site.

4.04.02 A scan survey will need to be carried out to establish the exact alignment of the gravity foul sewer within the site.

4.04.03 The development layout will need to be designed to have a minimum impact on the existing public sewers, with appropriate easements to be provided. Where this is not possible a sewer diversion will be required with the route agreed with United Utilities Limited.

4.05 Public Surface Water Drainage

4.05.01 The sewer record indicate an existing public surface water sewer 675mm diameter running across the site from Tunstall Road to the West boundary of the site.

4.05.02 A 225mm diameter and 675mm diameter storm sewer runs within Tunstall Road adjacent to the site.

4.05.03 A scan survey will eed to be carried out to establish the exact alignment or the storm sewer within the site.

4.05.04 Additional note from United Utilities Limited:

Since 1st October 2011 many private sewers have been transferred into the ownership of United Utilities Limited as public sewers, where two or more properties in separate ownership are served by those sewers. Most of these former private sewers will not be shown on the public sewer records, therefore a full site survey should be carried out prior to any

layout design or construction works to identify where these sewers may be and to avoid later delays and possible added costs.

4.05.05 The development layout will be designed to have a minimum impact on the existing sewers, with appropriate easements provided. Where this is not possible, a sewer diversion will be required with the route agreed with United Utilities Limited.

4.06 Hydrology

4.06.01 The only natural surface water features in the immediate vicinity of the site is a small distance 116m to the North-West of the site.

5.00 ENVIRONMENT AGENCY

5.01 The Environment Agency and Local Authority Flood Map shows the site to be within Flood Risk Zone 1 – with less than 1 in 1000 chance of flooding from rivers in any one year. The Environment Agency response can be found in Appendix 4

5.02 Applicable Planning Policy

5.02.01 Technical Guidance to the National Planning Policy Framework. It deals specifically with development planning zones. The main study requirement is to identify the flood zones and vulnerability classification relevant to the proposed residential development, based on an assessment of current and future conditions.

5.03 Planning Zones

5.03.01 The overall aim should be to steer new developments to Flood Zone 1. Where there is no reasonably available sites in Flood Zone 1, local planning and authorities allowing land in local plans or determining planning applications for development at any particular location should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 be considered, taking into account the flood risk vulnerability of land uses and applying the exception test if required.

Table 1 – Flood Zones

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 (<0.1%).	**Appropriate Uses** All uses of land are appropriate in this zone. **FRA 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. **FRA 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 systems.

Zone 3a: High Probability	
Definition This zone comprises land assessed as having between 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. **FRA 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 systems. • 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: Functional Floodplain	
Definition This zone comprises land where water has to flow or be stored in times of flood. 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	**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

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.	▪ Result in no net loss of floodplain storage ▪ Not impede water flows ▪ Not increase flood risk elsewhere **FRA 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 systems. ▪ Relocate existing development to land with a lower probability of flooding.

Table 2 – Flood Risk Vulnerability Classification

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 use. 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 and 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 (expect landfill and hazardous waste facilities). ▪ Minerals working and processing (except for sand and gravel working). ▪ Navigations facilities. ▪ Ministry of 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.
Water Compatible Development	▪ Water treatment works which do not need to remain operational during times of flood. ▪ Sewerage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place). ▪ Flood control infrastructure. ▪ Water transmission infrastructure and pumping stations. ▪ Sewerage transmission infrastructure and pumping stations. ▪ Sand and gravel working. ▪ Docks, marinas and wharves.

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)	Zone1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	X	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	X	X	X

Key: ✓ Development is appropriate

X Development should not be permitted

Notes to table:

This table does not show:

a) The application of the Sequential Test which guides development to Flood Zone 1 first, then Zone 2 and then Zone 3.
b) Flood Risk Assessment requirements, or
c) The Policy aims for each flood zone.

5.04 Staffordshire County Council

Staffordshire County Council has been consulted the Strategic Flood Risk Assessment (SFRA) has been reviewed to assess the potential flood risk to the site.

The purpose of the SFRA was to assess and map all forms of flood risk, from groundwater, surface water, impounded water bodies, sewer and river sources taking into account future climate change , to allow councils to use

this as an evidence base to locate future development primarily in flow flood risk areas.

A copy of the SFRA plan can be found in Appendix 5.

The SFRA states that the development situated within zone 1 the risk of other sources must be considered and sustainable urban drainage system employed were possible.

There are no current natural surface water features in the immediate vicinity of the site.

Staffordshire County Council advice was to refer to the Environment Agency flood maps for flood warning areas, flooding from surface water and flooding from reservoirs. Maps can be found in Appendix 5.

5.05 Strategic Flood Risk Assessment Summary

Surface Water Features	Ditch course 116m North-West of the site.
River and Coastal Flooding	None - Zone 1
Rofras Flooding	None
Historical Flooding	None
JBA Surface Water Pluvial Flooding	Assessed to be low to high risk.
Groundwater Flooding	Limited to potential.
JBA Reservoir and Canal	None
Flood Warning Zone	No

The strategic Flood Risk Assessment maps suggest that the site is not affected by fluvial flooding; therefore the site is located in Flood Zone 1.

A copy of the Flood Zone Maps and Ground Sure Report can be found in Appendix 5.

The surface water pluvial flooding map shows site to be low to high risk of flooding. These areas are most likely ponding of water within the site due to heavy rainfall on soils of clay nature and depressing in ground levels. Proposed development drainage system and proposed ground levels must be adequate to prevent localise ponding.

Groundwater flooding map shows low to medium susceptibility, care must be taken when constructing foundations. Medium potential for groundwater flooding is only located at the parking and access area and therefore satisfactory.

5.06 Environment Agency

5.06.01 The Environment Agency website was checked to assess the potential risk to the site from flooding.

5.06.02 The site is located in Flood Zone 1.

5.06.03 A copy of the Flood Map can be found in Appendix 5.

5.07 Potential Flood Risk to the Site

5.07.01 An appraisal was made of the site and surrounding areas to assess the potential risk of flooding at the site.

5.07.02 The site falls East towards the West.

5.07.03 It is unlikely any flooding from third party land will flow towards the adjacent site.

5.07.04 Flooding during heavy storms needs to be diverted away from the main buildings and towards the access, hardstanding and parking areas.

5.08 Flood Risk Assessment Summary

Possible Flood Mechanisms

Source/Pathway	Significant	Comment/Reason
Fluvial	No	No Risk
Tidal/Coastal	No	No Risk
Reservoir and Canal	No	No Risk
Groundwater	No	No Risk
Surface Water (pluvial)	Yes	Careful consideration should be given to levels within the site to avoid flat areas which are likely to attract flooding during heavy storms.
Blockage	Yes	Blockages could occur along the main sewers. Flood water should be diverted away from the main buildings.
Infrastructure Failure	Yes	There are United Utilities Limited sewers in close proximity to the site and a foul pumping station within the site boundary.

Flood Risk Assessment Summary

Aspects of Flood Risk Area liable to flooding	**Assessment/Comment** The development site lies within Flood Zone 1 of the Environment Agency Flood Zone Map.
Probability of flooding occurring	There are records of flooding from surface water or groundwater at the site.
Standard of existing flood defences and their effectiveness	N/A
Likely depth of flooding	N/A
Rates of flow likely to be involved	N/A
Likelihood of impacts to other areas, properties and habitats	Any increase in the surface area, SUDS will be used for surface water management.
Effects of climate	The effects of climate change on flooding at the site are likely to be limited.

6.00 EXISTING GROUND CONDITIONS

6.01 A ground investigation report was not available during the writing of the report.

6.02 Hydrology

6.02.01 No major hydrological features have been identified within the site or immediate vicinity. The nearest feature is a minor … approximately 116m North West of the site.

6.02.02 The site is not located within a ground water source protection zone as defined by the Environmental Agency Source Protection Zone Map.

6.02.03 In the accordance with the Environmental Agency's Ground Vulnerability Zones, the site is closed as a Minor Aquifer High.

6.03 Ground Conditions

6.03.01 **Ground Geology**

Six driven continuous sampling boreholes to depths of 5m bgl were carried out, in addition to six machine excavated trial pits to depths of up to 3m bgl and three rotary open hole boreholes

to investigate potential coal workings to depths of 30m bgl. Soakaway tests were carried out within the trail pits.

In general, up to 0.6m of cohesive and granular Made Ground was encountered across the site. Made Ground was considerably deeper across the landscaped spur of land in the northeast corner of the site, where it was encountered to depths of 2.4m bgl.

The Made Ground was underlain by Glacial Till, which was generally encountered as sandy gravelly clay, with local pockets/layers of sand and gravel.

The rotary boreholes indicate that the Glacial is present to depths of 17.4m bgl in the north-eastern part of the site, decreasing in thickness towards the south-western part of the site, where it was proven to a depth of 10.3 bgl.

6.03.02 Groundwater

Groundwater wasn't encountered during drilling of the boreholes or excavation of the trial pits.

Recent groundwater monitoring indicates groundwater levels between 0.85m and 3.65m bgl.

6.03.03 Soakway Design

Three soakaway tests were carried out in accordance with BRB 365 within the trial pits across the site, which indicate that the soils are not permeable.

In view of our recent findings, soakaways are not considered a viable drainage solution for the site

6.03.04 Hydrogeology

The Environment Agency classified the site area as a minor Aquifer High.

The Environment Agency have indicated that the site is not within a groundwater source protection zone.

7.00 DRAINAGE PROPOSALS

7.01 Storm Water Management

7.01.01 Flood risk in any area is controlled by a number of contributing factors. At the local scale, when developing or re-developing a site, it is usual to acknowledge that part of the site itself would play in contributing to, or potentially alleviating flood risk.

Any failure to implement a carefully considered storm water management plan is likely to result in peak flows to a local watercourse and in turn exacerbate flood risk downstream. Allowable levels of site storm water discharge from the site to the public sewer system has been discussed with United Utilities Limited.

7.02 Sustainable Urban Drainage Systems (SUDS)

7.02.01 Sustainable urban drainage systems (SUDS) involve the management of storm water from developments effectively in order to reduce the impact of run-off both to the site in question, and properties downstream and not to exacerbate existing problems. This is achieved by not increasing peak flows that will otherwise result from the development. The philosophy of SUDS is to mimic, as closely as possible, the natural drainage from a site before development, and to ensure that storm water runoff is treated so there is no detriment to water quality of the receiving watercourse.

Using a SUDS system may provide water quantity and quality control, as well as increased amenity value. Appropriately designed and maintained schemes may improve the sustainable water management at the site by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream.
- Reducing the volume, rate of discharge, and the frequency of water flowing directly to watercourses or sewers from the developed sites.
- Improving water quality compared with conventional surface water sewers by removing pollutants.

7.03 Potential SUDS Options on Site

7.03.01 The following represents our considered views on suitable SUDS options appropriate to this site. CIRIA C697 The SUDS

manual was consulted to examine the use of SUDS on this site. Our conclusions are based on the assessment of the site and the evaluation of the relevant design requirements and regulatory consultation.

7.04 Potential SUDS Techniques Considered for this Site

7.04.01 Source Control

7.04.01.01 Green Roofs

Green roofs comprise a multi-layered system that covers the roof of a building or podium structure with vegetation cover, over a drainage layer. They are designed to intercept and retain precipitation, reducing the volume of run-off and attenuating peak flows.
Cost to the structure can be considerable and poor maintenance will leave it looking unsightly.

Not recommended.

7.04.01.02 Soakaways

Soakaways are square or circular excavations, either filled with rubble or lined with brickwork, precast concrete or polyethylene rings/perforated storage structures surrounded by granular backfill. They can be grouped and linked together to drain large areas including highways. The supporting structure and backfill can be substituted by modular geocellular units. Soakaways provide storm water attenuation, storm water treatment and groundwater recharge.

The site is a low permeability classification.

Not recommended

7.04.01.03 Swales

Swales are linear vegetated drainage features in which surface water can be stored or conveyed. They can be designed to allow infiltration, where appropriate. They should promote low flow velocities to allow much of the

suspended particulate load in the storm water runoff to settle out, thus providing effective pollutant removal. Roadside swales can replace conventional gullies and drainage pipes. Swales are easy to incorporate into the landscape design it can reduce the run-off rates and volumes.

Not Recommended

7.04.01.04 Pervious Pavements

Pervious pavements provide a pavement suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into the underlying layers. The water is temporarily stored between infiltration to the ground, reuse or discharge to a watercourse or other drainage system. Pavements with aggregate sub-bases can provide good water quality treatment.
The use of permeable paving for parking bays can be used as a stone sub-base not only stores and slows down the rate of discharge, but also raises the water quality.

Recommended

7.04.01.05 Geo-cellular/Modular Systems

Modular plastic geo-cellular systems with a high void ratio that can be used to create a below ground storage structure.
Modular tanks can be used for run off attenuation but requires silt trap protection and a suitable means of access for cleaning and inspection.

Recommended

7.04.01.06 Ponds

Ponds can provide both storm water attenuation and treatment. They are designed to support emergent and submerged aquatic vegetation along their shoreline. Run off from each rain event is detained and treated in the pool. The retention time promotes removal through sedimentation and the opportunity for biological

uptake mechanisms to reduce nutrient concentrations.
The proposed site offers limited space for a pond structure to be incorporated within the design.

Not Recommended

7.05 Surface Water Assessment

7.05.01 United Utilities Limited and the Environment Agency guidelines on Greenfield and Brownfield developments must be adhered to for this site.

7.05.02 United Utilities Limited developer's enquiry has been submitted and the response was not received during the writing of this report.

7.05.03 With regard to soakaway design due to the clay strata and the results of the soakaway test, the ground is considered unsuitable for soakaway

7.06 Greenfield Runoff Assessment

7.06.01 The existing site plan is classed as a Brownfield site. But due to legalisation introduced from the 6th April 2015 we need to consider this site as Greenfield.

7.06.02 The Greenfield runoff calculation using Institute of Hydrology Report 123 (IOH 124) and the Interim Code of Practice for SUDS have been undertaken. A copy of the windes Greenfield calculations can be found in Appendix 7.

7.06.03 Based on the total site area being approximately 0.9552 Ha results for Greenfield runoff rates are as follows:-

Return Period	1:1 Year	1:30 Year	1:100 Year	Q-bar
Greenfield Runoff Rate (l/s)	5.1	12.1	15.8	6.2

The based are the following characteristics:

- Soil type: 4
- SPR: 0.47
- SAAR: 896mm
- M5-60 Rainfall Depth: 20mm
- % Ratios: 0.4

7.06.04 Refer to Appendix 7 for Greenfield runoff calculations.

7.06.05 In accordance with NPPF any development shall be limited surface water discharge to no more than Greenfield runoff rate.

7.07 Proposed Development Discharge

7.07.01 It is proposed that the surface water will discharge into the public storm sewer.

7.07.02 It is proposed to limit the surface water discharge rate from the development to the Greenfield rate (5.1l/s) for all return periods up to and including the 100 year storm with allowance of 30% for the potential effects of climate change.

7.07.03 The maximum allowable discharge = 5.1l/s

7.07.04 The total proposed contributing area is calculated at 0.5083 Ha.

7.07.05 A copy of the proposed impermeable area plan can be found in Appendix 7.

7.07.06 Based upon the maximum allowable discharge, the table below shows the amount of attenuation required for any given return period.

Return Period	**Max Flow l/s**	**Attenuated Volumes m³**
2	5.1	60
30	5.1	137
100	5.1	195
100 + 30%	5.1	270

7.07.07 The development layout shall be designed to have a minimum impact on the existing sewers, with easements provided to United Utilities requirement. Where this is not possible, a sewer diversion will be required with the route agreed with United Utilities Limited.

7.07.08 CWA have prepared a surface water strategy which can be found in Appendix 6.

7.07.09 CWA have prepared micro-drainage calculations which can be found in Appendix 7.

7.07.10 It is proposed to provide capacity for surface water from storm events up to the 100 year plus 30% return period within the boundary of the development.

7.07.11 It is proposed that the attenuation storage be provided by an attenuation tank located toward the development.

7.07.12 United Utilities will have to be consulted, regarding storm discharge of 5.1l/s into the public storm sewers.

7.08 Foul Water Discharge

7.08.01 It is our proposals to discharge foul water from the development into the existing public foul sewer.

7.08.02 United Utilities Limited have confirmed verbally, an unrestricted foul water discharge into the public foul sewers. United Utilities Limited developer's enquiry has been submitted and the response was not received, during the writing of this report.

7.08.03 A separate foul water drainage system is to be provided within the site.

7.08.04 It is our proposals to discharge foul water which equates to 3.5 l/s from the development into the foul gravity sewers.

7.08.05 The development layout shall be designed to have a minimum impact on the existing sewers, with easements provided to United Utilities requirements. Where this is not possible, a sewer diversion will be required with the route agreed with United Utilities Limited.

7.08.06 CWA have prepared a foul water strategy which can be found in Appendix 6.

8.00 CONCLUSIONS

8.01 United Utilities Limited has been contacted and documents have been reviewed to determine the foul and surface water strategy for this development.

8.02 Foul water will discharge into the existing public foul sewer at rate of 3.5 l/s.

8.03 Surface water will discharge into the existing public sewer and is restricted to 5.1l/s into the existing public surface water sewer.

8.04 Attenuation will be provided through storage tanks, storage pipes and flow restricted utilising a flow controlled device.

8.05 Porous paving (tanked) has been considered where possible within parking areas.

8.06 The use of sustainable urban drainage (SUDS) has been considered and can be incorporated within the design. Attenuation tanks and tankel porous paving have all been used.

8.07 Further onsite soakaway were carried out and the site is deemed not to be suitable for infiltration techniques, for surface water disposal.

8.08 The site lies within the Environment Agency Flood Zone 1. The location of the proposals is therefore appropriate.

8.09 The proposed development will not be affected by current or future flooding from any source.

8.10 The development will not increase the flood risk elsewhere (to wider catchment area) as a result of suitable management of surface water runoff discharging from the site.

8.11 The measure proposed to deal with the effects and risks are appropriate.

8.12 Other origins of flooding have also been assessed and it has been found that there will be no increase in the risk of flooding from ground water or sewers as a result of this development.

8.13 This report has been prepared to meet the requirements of National Planning Policy Framework for a site not at risk of flooding.