UK Flood Risk
Flood Risk Consultants

# *Flood Risk Assessment*

## Land Adjacent to Welbury Road, Wythenshawe, Manchester M23 0JP

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**UK Flood Risk**
41 Stanham Road
Dartford DA1 3AN

Tel: 020 3797 6380

Email: ukfloodrisk@gmail.com
**www.ukfloodrisk.co.uk**

UK Flood Risk
Flood Risk Consultants

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UK Flood Risk Ltd
41 Stanham Road
Dartford DA1 3AN

# Executive Summary

UK Flood Risk Consultants has been commissioned to prepare this Flood Risk Assessment (FRA) in support of a proposal consisting of residential development with 4 no. 3-bed semi-detached dwellings along with a new car park located at the land adjacent to Welbury Road, Wythenshawe, Manchester M23 0JP.

The main sources of information to undertake flood risk assessment are the flood maps and data of the Environment Agency and the previous flood studies by the Local Authority.

The proposed development is categorised as ‘more vulnerable’. The site is located in Flood Zone 2. Therefore, the proposed development is appropriate at this location.

The site is located in close proximity to the Baguley Brook with the risk of fluvial flooding.

According to the information available from the SFRA and the Environment Agency, there were no records of flooding events at the site.

The Environment Agency’s Flood Maps show that the site lies within the Flood Zone 2 (medium probability flooding). Flood Zone 2 fluvial outline shows a land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding.

The Environment Agency’s flood risk map indicates that the risk of flooding to the site is 'low'.

The Environment Agency’s modelling data indicated that under the undefended condition the site is not subject to flooding from the 1% AEP (1 in 100 year). However, the site is subject to a shallow flood depth of 0.13m from the 1% AEP (1 in 100 year) plus central climate change event. This implies that the flood hazard to the people and the property from these extreme events is relatively low.

The overall risk of surface water flooding to the site is 'low'.

The flood risk from other sources including underground water, sewer and reservoir is low.

In order to afford a level of protection against flooding it is normally recommended that finished floor levels are set a nominal 300mm above the 1 in 100-year annual probability fluvial flood (1% AEP) including an allowance for climate change. The Environment Agency’s modelling data indicated that the 1 in 100 year (1%AEP) plus Central Climate Change water level near the site is 29.67mAOD.

Therefore, it is proposed that the finished floor level of the proposed buildings will be set not lower than 29.97mAOD which is 0.43m above the lowest ground level of 29.54mAOD and will provide a nominal freeboard of 300mm.

In order to minimise the damage and to enable quick recovery and clean up after the flooding event, it is proposed that flood resilient measures will be implemented.

As the site is located within a flood zone area, it will be necessary to make sure that the occupants are fully aware of the flood risk and flood warning and evacuation during an extreme event. If necessary, during a flood event the first floor will provide a safe haven for the occupants.

The occupants are advised to utilise the Environment Agency's Flood Warning Service available in the area.

The surface runoff will be improved by implementing appropriate SuDS measures. Based on the general assessment of the potential SuDS measures, there is potential of several SuDS measures such as rainwater butt, permeable paving and soakaway. It is proposed that a site-specific Sustainable Urban Drainage Systems (SuDS) Strategy will be developed in the next phase of the proposal.

The landowners will be fully responsible for the repair and management of the implemented SuDS throughout the lifetime of the proposed development.

The development will not give rise to backwater affects or divert water towards other properties.

This report demonstrates that the proposal will be safe, in terms of flood risk, for its design life and will not increase the flood risk elsewhere.

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## Abbreviations

| Abbreviation | Description |
|---|---|
| mAOD | Metres Above Ordnance Datum |
| DEFRA | Department for Environment, Food, and Rural Affairs |
| EA | Environment Agency |
| FRA | Flood Risk Assessment |
| LLFA | Lead Local Flood Authority |
| NPPF | National Planning Policy Framework |
| SFRA | Strategic Flood Risk Assessment |
| PFRA | Preliminary Flood Risk Assessment |
| SuDS | Sustainable Drainage Systems |

# 1.0 Background

UK Flood Risk Consultants has been commissioned to prepare this Flood Risk Assessment (FRA) in support of a proposal consisting of residential development with 4 no. 3-bed semi-detached dwellings along with a new car park located at the land adjacent to Welbury Road, Wythenshawe, Manchester M23 0JP.

This FRA has been carried out in accordance with the requirements of the National Planning Policy Framework (NPPF, July 2021) and the Environment Agency's Flood Risk Assessment (FRA) Guidance Notes and the best practices in flood risk management.

The National Planning Policy Framework sets out planning policy in order to avoid inappropriate development in areas at risk of flooding by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

# 2.0 FRA Requirements and Objectives

The site-specific FRA should address the following:

- how flood risk affects the proposed development,
- whether the development type is appropriate for the proposed location,
- whether the site's flood risk is too great for the development,
- whether the proposed development will increase flood risk elsewhere,
- carry out the Sequential Test and the Exception Test where necessary,
- meet the additional flood resistance and resilience requirements where necessary.

The objectives of this site-specific flood risk assessment are to establish:

- whether the proposed development is likely to be affected by current or future flooding from any source,
- whether it will increase flood risk elsewhere,
- whether the measures proposed to deal with these effects and risks are appropriate,

# 3.0 General Description of the Site and the Proposals

## 3.1. Description of the site

The proposal site is located at the land adjacent to Welbury Road, Wythenshawe, Manchester M23 0JP approximately centred on the OS NGR SJ 80620 90366(**Appendix A Figure 1**). The site is located within the administrative boundary of Manchester City Council, which is the Local Planning Authority.

The site is located within a predominately residential area with some small commercial businesses on Moorcroft Road. The site is currently used for storage purposes and has a car park which is presumed to be for the commercial tenants on Moorcroft Road. The site has 2 points of access, directly off Welbury Road and Aldfield Road.

The surrounding area consists of predominantly residential use (**Appendix A Figure 2)**.

The British Geological Survey's geological maps are provided in **Appendix A Figure 3**. The geological maps show that the bedrock of the site comprises Tarporley Siltstone Formation - Siltstone, mudstone and sandstone that formed between 250 and 241.5 million years ago during the Triassic period. The superficial deposits consist of Glaciofluvial Sheet Deposits, Devensian - Sand and gravel that formed between 116 and 11.8 thousand years ago during the Quaternary period.

The site is located in close proximity to the Baguley Brook with the risk of fluvial flooding.

The site topography is relatively flat and level with the general elevation varying from 29.54mAOD to 29.67mAOD. Further details about the existing site are provided in **Appendix B**.

## 3.2. Proposed Development

The proposal consists of residential development with 4 no. 3-bed semi-detached dwellings along with a new car park. Further details about the proposals have been provided in **Appendix B**.

# 4.0 Development and Flood Risk Policy

## 4.1. National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF, July 2021) sets out the government's planning policies for England. The NPPF sets out planning and policies related to development planning and flood risk using a sequential characterisation of risk based on planning zones and the Environment Agency's Flood Maps. The aim of the flood risk assessment is to identify which Flood Zones the site is located in and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

## 4.2. Flood Zones

The Flood Zones refer to the probability of river and sea flooding which ignores the presence of defences. The national flood maps have been developed by the Environment Agency that shows the risk of tidal and/or fluvial flooding across England and Wales for different return period events. The Environment Agency's Flood Maps are the maps which have been developed using broad scale hydraulic modelling. It is therefore important to understand that the flood maps may not be very accurate at a site-specific level which may need further field observation and measurements. The Flood Zones do not take into account of the climate change impacts which must be considered in any flood risk assessment as required by the NPPF.

## 4.3. Sequential and Exception Tests

As set out in the NPPF, the overall aim of the Sequential Test should be to steer new development to Flood Zone 1 (Low Probability Flooding). Where there are no reasonably available sites in Flood Zone 1, the Local Authority should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2, applying the Exception Test if required. Where there are no reasonably available sites in Flood Zones 1 or 2, the suitability of sites in Flood Zone 3 should be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

The Exception Test, as set out in the NPPF Framework, is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available. There are two requirements to meet for the Exception Tests. The proposed development will provide wider sustainability benefits

to the community that outweigh flood risk, and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

## 4.4. Vulnerability of Use and Flood Risk Assessment

The proposed development is categorised as 'more vulnerable' (**Table 2**). The site is located in Flood Zone 2 (medium probability flooding). The proposed development is therefore considered appropriate at this location (**Table 3**). It should be ensured that all types of flood risk are considered as part of the Flood Risk Assessment: *'A site-specific Flood Risk Assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall'.*

This FRA aims to demonstrate that the proposal will remain safe for its lifetime and will not increase flood risk elsewhere.

## 4.5. NPPF Flood Zones

Table 1 below shows the NPPF Flood Zones and the requirements and policy aims in terms of undertaking site-specific flood risk assessment.

Table 1 - NPPF Flood Zones and Requirements (NPPF Technical Guidance Table 1)

| **Zone 1: Low Probability Flood Zone** | **This is defined as the 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. |
| **FRA requirements** | For development proposals on sites comprising 1 ha 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 FRA. |
| **Policy aims** | Developers and local authorities should seek opportunities to reduce the overall level of flood risk through the layout and form of the development, and the appropriate application of sustainable drainage techniques. |

| **Zone 2: Medium Probability Flood Zone** | **This is defined as the 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** | The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table 2 are appropriate in this zone.<br>Highly vulnerable uses in Table 2 are only appropriate in this zone if the Exception Test is passed. |
| **FRA requirements** | All proposals in this zone should be accompanied by a FRA. |
| **Policy aims** | Developers and local authorities should seek opportunities to reduce the overall level of flood risk through the layout and form of the development, and the appropriate application of sustainable drainage techniques. |
| **Zone 3a: High Probability Flood Zone** | **This is defined as the 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 in Table 2 are appropriate in this zone.<br>The highly vulnerable uses (Table 2) should not be permitted in this zone.<br>The more vulnerable and essential infrastructure uses in Table 2 should only be permitted in this zone if the Exception Test is passed. |
| **FRA requirements** | All proposals in this zone should be accompanied by a FRA. |
| **Policy aims** | Developers and local authorities should seek opportunities to:<br>❖ reduce the overall level of flood risk through the layout and form of the development and the |

| | |
|---|---|
| | appropriate application of sustainable drainage techniques;<br>❖ relocate existing development to land with a lower probability of flooding;<br>❖ create space for flooding to occur by allocating and safeguarding open space for flood storage. |
| **Zone 3b: Functional Floodplain** | **This is the land where water has to flow or be stored in times of flood. This zone is generally defined as the land which would flood with an annual probability of 1 in 20 (5%AEP) or greater in any year. The Local Council may define the Functional Floodplain area with a different annual probability of event.** |
| **Appropriate uses** | Only the water-compatible uses and the essential infrastructure listed in Table 2 that has to be there should be permitted. It should be designed and constructed to:<br>❖ remain operational and safe for users in times of flood;<br>❖ result in no net loss of floodplain storage;<br>❖ not impede water flows;<br>❖ not increase flood risk elsewhere. |
| **FRA requirements** | All proposals in this zone should be accompanied by a FRA. |
| **Policy aims** | In this zone, developers and local authorities should seek opportunities to:<br>❖ reduce the overall level of flood risk through the layout and form of the development and the appropriate application of sustainable drainage techniques;<br>❖ relocate existing development to land with a lower probability of flooding. |

Table 2 - Flood Risk Vulnerability Classification (NPPF Technical Guidance Table 2)

| | |
|---|---|
| **Essential Infrastructure** | Essential transport infrastructure and strategic utility infrastructure, including electricity generating power stations and grid and primary substations. |
| **Highly Vulnerable** | ❖ Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations and emergency dispersal points.<br>❖ Basement dwellings, caravans, mobile homes and park homes intended for permanent residential use.<br>❖ Installations requiring hazardous substances consent. |
| **More Vulnerable** | ❖ Hospitals, residential institutions such as residential care homes, children's homes,<br>❖ Social services homes, prisons and hostels.<br>❖ Buildings used for: dwelling houses, student halls of residence, drinking establishments, nightclubs, hotels and sites used for holiday or short-let caravans and camping.<br>❖ Non–residential uses for health services, nurseries and education.<br>❖ Landfill and waste management facilities for hazardous waste. |
| **Less Vulnerable** | ❖ Buildings used for shops, financial, professional and other services, restaurants and cafes, offices, industry, storage and distribution, and assembly and leisure.<br>❖ Land and buildings used for agriculture and forestry.<br>❖ Waste treatment (except landfill and hazardous waste facilities), minerals working and processing (except for sand and gravel).<br>❖ Water treatment plants and sewage treatment plants (if adequate pollution control measures are in place). |

| | |
|---|---|
| **Water-compatible Development** | ❖ Flood control infrastructure, water transmission infrastructure and pumping stations.<br>❖ Sewage transmission infrastructure and pumping stations.<br>❖ Sand and gravel workings.<br>❖ Docks, marinas and wharves, navigation facilities.<br>❖ MOD defence installations.<br>❖ Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location<br>❖ Water-based recreation (excluding sleeping accommodation).<br>❖ Lifeguard and coastguard stations.<br>❖ Amenity open space, nature conservation and biodiversity, outdoor sports and recreation.<br>❖ Essential sleeping or residential accommodation for staff required by uses in this category, subject to a warning and evacuation plan. |

Table 3 - Flood Risk Vulnerability and Flood Zone 'compatibility'

| **Vulnerability Classification (Refer Table 2)** | | **Essential Infrastructure** | **Water Compatible** | **Highly Vulnerable** | **More Vulnerable** | **Less Vulnerable** |
|---|---|---|---|---|---|---|
| Flood Zones | Flood Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Flood Zone 2 | ✓ | ✓ | Exception Test | ✓ | ✓ |
| | Flood Zone 3a | Exception Test | ✓ | ✗ | Exception Test | ✓ |
| | Flood Zone 3b | Exception Test | ✓ | ✗ | ✗ | ✗ |

✓ Development is appropriate

✗ Development should not be permitted

# 5.0 Assessment of Flood Risk

## 5.1. History of Flooding

The Manchester City Council's Strategic Flood Risk Assessment, Level 1 SFRA (March 2010) has provided brief information about past flooding events in the area. The SFRA reported some past flooding incidents in the area, however, there were no records of any flooding event at the site.

In addition, information on historic floods was obtained from the Environment Agency (**Appendix C**). However, there were no records of any flooding incidents around the site.

Information on the past flooding event was also obtained from the landowner. They were not aware of any flooding issues at the site.

## 5.2. Risk of Fluvial Flooding

The site is located in close proximity to the Baguley Brook with the risk of fluvial flooding. The Environment Agency's Flood Map around the site is shown in **Appendix A Figure 4** which shows that the site lies within the Flood Zone 2 (medium probability flooding). Flood Zone 2 fluvial outline shows a land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding.

**Figure 5** shows the Environment Agency's flood risk map which indicates that is 'low'.

## 5.3. Impact of Climate Change

In July 2021 the 'Flood Risk Assessments: Climate Change Allowances' were updated from the originally published Climate Change allowances on GOV.UK. The guidelines outline the peak river flow climate change allowances by management catchment. The range of Climate Change allowances is based on percentiles. A percentile is a measure used in statistics to describe the proportion of possible scenarios that fall below an allowance level. The 50th percentile is the point at which half of the possible scenarios for peak flows fall below it and half fall above it. The central allowance is based on the 50th percentile, higher central is based on the 70th percentile and the upper end is based on the 90th percentile.

The proposal site is located within the Mersey Upper Management Catchment and within the North West river basin district. The relevant climate change allowances are summarised in **Table 4** below.

Table 4 - Peak river flow allowances by Management Catchment and river basin district

| Management Catchment Name / River Basin District | Climate Change allowance | Total potential change anticipated for the '2020s' (2015 to 2039) | Total potential change anticipated for the '2050s' (2040 to 2069) | Total potential change anticipated for the '2080s' (2070 to 2115) |
|---|---|---|---|---|
| Mersey Upper / North West | Upper end | 27% | 51% | 85% |
| | Higher central | 17% | 31% | 53% |
| | Central | 13% | 22% | 41% |

**Using peak river flow allowances for flood risk assessments**

The guideline suggests to consider the flood zone and the appropriate flood risk vulnerability classification to decide which allowances applies to the development or plan.

In flood zones 2 or 3a for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – use central allowance (development should not be permitted in flood zone 3a)
- more vulnerable – use the central allowance
- less vulnerable – use the central allowance
- water compatible – use the central allowance

In flood zone 3b for:

- essential infrastructure – use the higher central allowance
- highly vulnerable – development should not be permitted
- more vulnerable – development should not be permitted
- less vulnerable – development should not be permitted

- water compatible – use the central allowance

**Assessment of Climate Change Impact for the Site**

The proposal site is located within the Mersey Upper Management Catchment and within the North West river basin district. As the proposed development is categorised as 'more vulnerable' and the site is located in Flood Zone 2 (i.e. medium probability flooding), the guideline recommends to use the Central allowance for assessing the impact of climate change. The Central allowance for the Mersey Upper/North West River Basin District is 41% for the period between 2070 and 2115 (**Table 4**). However, information on 41% climate change event and flood levels was not available in the Environment Agency's model which used a 20% climate change. Therefore, the 0.1%AEP (i.e. 1 in 1000 year) water levels have been considered equivalent to the 1%AEP (i.e. 1 in 100 year) plus central climate change water levels for assessing the flood risk to the site.

## 5.4. Modelled Water Levels

Information on modelled water levels was obtained from the Environment Agency (**Appendix C**). The site-specific modelled flood levels at the proposed development site have been taken from the fluvial model of Baguley Brook. The modelled flood

**Appendix C** also contains a 2D model node location map near the site. The map shows that the nearest model nodes are Node 5 and Node 6.

**Comparison of Modelled Water Levels and the Site Levels**

The modelled water levels (i.e.2D node water levels) have been compared against the existing site levels (**Table 5**). The information on the site levels have been taken from the topographic map provided in **Appendix B**.

**Table 5** shows that under the undefended condition the site is not subject to flooding from the 1% AEP (1 in 100 year). However, the site is subject to a shallow flood depth of 0.13m from the 1% AEP (1 in 100 year) plus central climate change event. This implies that the flood hazard to the people and the property from these extreme events is relatively low.

Table 5 – Comparison of modelled water levels against the site levels (undefended condition)

| Events | Modelled levels, mAOD | General Site Level, mAOD | Max flood depth, m |
|---|---|---|---|
| 5% AEP (1 in 20 year) | No flooding | 29.54-29.67 | No flooding |
| 1% AEP (1 in 100 year) | No flooding | 29.54-29.67 | No flooding |
| [♯]1% AEP (1 in 100 year) plus Central CC | 29.67 | 29.54-29.67 | 0.13 |
| 0.1 %AEP (1 in 1000 year) | 29.67 | 29.54-29.67 | 0.13 |

[♯] 0.1%AEP (i.e. 1 in 1000 year) water levels have been considered equivalent to the 1%AEP (i.e. 1 in 100 year) plus central climate change water levels, see **Chapter 5.10**.

## 5.5. Risk of Tidal Flooding

The watercourse (i.e. Baguley Brook) is not influenced by tidal waves at this location. The risk of tidal flooding is therefore low.

## 5.6. Risk of Flooding From Artificial Water Bodies

There were no known flood risks from any artificial water bodies near the site.

## 5.7. Risk of Groundwater Flooding

In recent years groundwater has been recognised as a significant source of flooding in the UK. According to the British Geological Survey, groundwater flooding occurs when the water table in permeable rocks rises to enter basements/cellars or comes up above the ground surface. Groundwater flooding is not necessarily linked directly to a specific rainfall event and is generally of longer duration than other causes of flooding (possibly lasting for weeks or even months).

Evidence of historical groundwater flooding within the SFRA is very limited, however it is important to recognise that the risk of groundwater flooding is highly variable and heavily dependent upon local conditions at any particular time.

According to the information available from the landowner, there were no records of any groundwater flooding incidents around the site. Based on these evidences and information, it is reasonable to consider that the risk of groundwater flooding to the site is low.

## 5.8. Risk of Surface Water Flooding

The surface water flooding arises when the infiltration capacity of land or the drainage capacity of a local sewer network is exceeded and the excess rainwater flows overland. The severity of surface water flooding depends on several factors such as the degree of saturation of the soil before the event, the permeability of soils and geology, hill slope steepness and the intensity of land use.

Information on the risk of surface water flooding is held by the Environment Agency. The Environment Agency's Surface Water Flood Risk Maps are provided in **Appendix A Figure 6 and Figure 7** which indicate that the risk of surface water flooding to the site is 'low'.

## 5.9. Risk of flooding from Reservoirs

The Environment Agency's reservoir flood map in **Appendix A Figure 8** indicated that the proposal site is located outside of the maximum extent of flooding from reservoir. According to the Environment Agency, the reservoir flooding is extremely unlikely to happen and reservoirs in the UK have an extremely good safety record; indeed there has been no loss of life in the UK from reservoir flooding since 1925. The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers on a regular basis. It is therefore assumed that these reservoirs are regularly inspected, and essential safety work is carried out. These reservoirs therefore present a managed residual risk.

## 5.10. Flood Risk from Sewers

Sewer flooding is often caused by excess surface water entering the drainage network causing sewers to surcharge. The SFRA has provided very limited information on sewer flooding within the area, however, there were no records of sewer flooding incidents at the site. It is important to note that previous sewer flood incidents or the lack thereof do not indicate the current or future risk to the site as upgrade work could have been carried out to alleviate any issues or conversely in areas that have not experienced sewer flooding incidents the local drainage infrastructure could deteriorate leading to future flooding.

According to the information obtained from the landowner, there were no records of sewer flooding incidents at the site in the past.

# 6.0 Mitigation Measures

## 6.1. Recommended Finished Floor Level

In order to afford a level of protection against flooding it is normally recommended that finished floor levels are set a nominal 300mm above the 1 in 100-year annual probability fluvial flood (1% AEP) including an allowance for climate change. The Environment Agency's modelling data indicated that the 1 in 100 year (1%AEP) plus Central Climate Change water level near the site is 29.67mAOD. Therefore, it is proposed that the finished floor level of the proposed buildings will be set not lower than 29.97mAOD which is 0.43m above the lowest ground level of 29.54mAOD and will provide a nominal freeboard of 300mm.

## 6.2. Flood Resilient Measures (Up to 600mm from Ground Level)

The following flood resilient measures will be adopted, where practicable, to minimise the damage and to enable quick recovery and clean up after the flooding event:

- Water, electricity and gas meters will be located above predicted flood level.
- Non-return valves will be used in the drainage system to prevent back-flow of diluted sewage in situations where there is an identified risk of the foul sewer surcharging.
- All service entries will be sealed (e.g. with expanding foam or similar closed cell material).
- Closed cell insulation will be used for pipes which are below the predicted flood level.
- Boiler units and ancillary devices will be installed above predicted flood level and preferably on the first floor of two-storey properties.
- Wiring for telephone, TV, Internet and other services will be protected by suitable insulation to minimise damage.
- Building materials that are effective for a 'water exclusion strategy' will be used which include: engineering bricks, cement-based materials including water retaining concrete and dense stone.

## 6.3. Flood Warning and Evacuation

As the site is located within a flood zone area, it will be necessary to make sure that the occupants are fully aware of the flood risk and flood warning and evacuation during an extreme event. If necessary, during a flood event the first floor will provide a safe haven for the occupants.

### 6.3.1. Flood Warnings Direct

The occupants are advised to utilise the Environment Agency's Flood Warnings Direct which is a free flood warning service called Floodline Warnings Direct (FWD). This service generally gives an advance notice of when flooding is likely to happen and time to prepare for a flood event. Property owners on the proposed development site will be able to sign up to FWD online using the following contact details (**Table 6**):

Table 6- Contacts for flood warning services

| Methods | Remarks |
|---|---|
| Online | https://fwd.environment-agency.gov.uk/app/olr/register |
| Telephone | 0345 988 1188 |

### 6.3.2. Flood Warning Service

The Flood Warning Service is provided by the Environment Agency across England and Wales in areas at risk of flooding from rivers or the sea. This is provided using up to date rainfall, river level and sea condition monitoring 24 hours a day to forecast the possibility of flooding. If flooding is forecast, the Environment Agency will issue warnings using a set of three different warning types **(Table 7).** Many areas of England are covered by the full four stages of the Environment Agency's Flood Warning Service. The site is located in an area covered by the Flood Alert Services **(Appendix A Figure 9).** The Environment Agency's Flood Warning target lead time; the time between a flood warning being issued and the onset of flooding is approximately two hours. Providing the Environment Agency can meet their target Flood Warning lead time, the occupants of the proposed development will have two hours to ensure that property is relocated to minimise risk and evacuation to safe locations can be carried out.

Table 7 - Environment Agency's Flood Warning Codes

| Flood Warning Code | Meaning | Actions to be taken |
|---|---|---|
| | Flooding is possible. Be prepared. | • Be prepared to act on your flood plan.<br>• Prepare a flood kit of essential items.<br>• Monitor local water levels and the flood forecast on our website. |
| | Flooding is expected. Immediate action required. | • Move family, pets and valuables to a safe place.<br>• Turn off gas, electricity and water supplies if safe to do so.<br>• Put flood protection equipment in place. |
| | Severe flooding. Danger to life. | • Stay in a safe place with a means of escape.<br>• Be ready should you need to evacuate from your home.<br>• Co-operate with the emergency services.<br>• Call 999 if you are in immediate danger. |
| **Warnings no longer in force** | No further flooding is currently expected in your area. | • Be careful. Flood water may still be around for several days.<br>• If you've been flooded, ring your insurance company as soon as possible. |

## 6.4. Surface Water Management

### 6.4.1. Hierarchy of SuDS Measures

The surface runoff from the site will be improved by implementing appropriate SuDS. The requirements for SuDS will ensure that any redevelopment or new development does not negatively contribute to the surface water flood risk of other properties and instead provides a positive benefit to the level of risk in the area. It will also ensure that appropriate measures are taken to increase the flood resilience of new properties and developments in surface water flood risk areas, such as those identified as being locally important flood risk areas.

The SuDS hierarchy and management train has been discussed in the SuDS Manual (C753) which aims to mimic the natural catchment processes as closely as possible. The general hierarchy of the SuDS measures is provided in **Table 8** below.

Table 8 General Hierarchy of SuDS Measures

| Measures | Definition/Description |
|---|---|
| Prevention | The use of good site design and housekeeping measures to prevent runoff and pollution (e.g. rainwater harvesting/reuse). |
| Source control | Control of runoff at or very near its source (e.g. soakaways, porous and pervious surfaces, green roofs). |
| Site control | Management of water in a local area on site (e.g. routing water to large soakaways, infiltration or detention basins) |
| Regional control | Management of runoff from a site or several sites (e.g. balancing ponds, wetlands). |

**Table 9** below presents the feasibility assessment of the SuDS measures for the site.

Table 9 General Assessment of SuDS measures for the site

| SuDS Measures | Issues/Description | Feasibility for the site |
|---|---|---|
| **Prevention**<br>Good site design and housekeeping/rainwater harvesting/infiltration devices/education. | Surface runoff can be improved by implementing rainwater harvesting using water butt. | Yes. There is potential for rainwater harvesting (water butt) to storage the runoff from roof and utilise the water for gardening, cleaning etc. |

| | | |
|---|---|---|
| **Source Control**<br>Porous and pervious materials/soakaways/green roof/infiltration trenches/disconnect downpipes to drain to lawns or infiltrate to soakaway. | Infiltration SuDS such as Soakaway and Permeable paving will improve the surface runoff from the site. | Yes. There is potential for soakaway and permeable paving in order to improve the surface runoff. |
| **Site and Regional Control**<br>Infiltration/detention basins/ balancing ponds/ wetlands/underground storage/swales/retention ponds. | Balancing pond/storage will not be feasible due to limited space available. | No. The potential for balancing pond/storage is low as there is very limited space available for any storage. |

Based on the general assessment of the potential SuDS measures above, there is potential of several SuDS measures such as rainwater butt, permeable paving and soakaway. It is proposed that a site-specific Sustainable Urban Drainage Systems (SuDS) Strategy will be developed in the next phase of the proposal.

## 7.0 Assessment of Impact on flow of floodwater

The proposed development consists of residential development with 4 no. 3-bed semi-detached dwellings along with a new car park. In order to ensure that the proposed development will not increase flood risk elsewhere the mitigations will ensure that all flood water, surface water and rainwater is processed on-site and not redirected elsewhere through the use of appropriate SuDS measures as mentioned above. The development will not give rise to backwater affects or divert water towards other properties.

# 8.0 Conclusion

The proposal consists of residential development with 4 no. 3-bed semi-detached dwellings along with a new car park located at the land adjacent to Welbury Road, Wythenshawe, Manchester M23 0JP.

The proposed development is categorised as 'more vulnerable'. The site is located in Flood Zone 2. Therefore, the proposed development is appropriate at this location.

The site is located in close proximity to the Baguley Brook with the risk of fluvial flooding.

According to the information available from the SFRA and the Environment Agency, there were no records of flooding events at the site.

The Environment Agency's Flood Maps show that the site lies within the Flood Zone 2 (medium probability flooding). Flood Zone 2 fluvial outline shows a land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding.

The Environment Agency's flood risk map indicates that the risk of flooding to the site is 'low'.

The Environment Agency's modelling data indicated that under the undefended condition the site is not subject to flooding from the 1% AEP (1 in 100 year). However, the site is subject to a shallow flood depth of 0.13m from the 1% AEP (1 in 100 year) plus central climate change event. This implies that the flood hazard to the people and the property from these extreme events is relatively low.

The overall risk of surface water flooding to the site is 'low'.

The flood risk from other sources including underground water, sewer and reservoir is low.

In order to afford a level of protection against flooding it is normally recommended that finished floor levels are set a nominal 300mm above the 1 in 100-year annual probability fluvial flood (1% AEP) including an allowance for climate change. The Environment Agency's modelling data indicated that the 1 in 100 year (1%AEP) plus Central Climate Change water level near the site is 29.67mAOD. Therefore, it is proposed that the finished floor level of the proposed buildings will be set not lower than 29.97mAOD which is 0.43m above the lowest ground level of 29.54mAOD and will provide a nominal freeboard of 300mm.

In order to minimise the damage and to enable quick recovery and clean up after the flooding event, it is proposed that flood resilient measures will be implemented.

As the site is located within a flood zone area, it will be necessary to make sure that the occupants are fully aware of the flood risk and flood warning and evacuation during an extreme event. If necessary, during a flood event the first floor will provide a safe haven for the occupants.

The occupants are advised to utilise the Environment Agency's Flood Warning Service available in the area.

The surface runoff will be improved by implementing appropriate SuDS measures. Based on the general assessment of the potential SuDS measures, there is potential of several SuDS measures such as rainwater butt, permeable paving and soakaway. It is proposed that a site-specific Sustainable Urban Drainage Systems (SuDS) Strategy will be developed in the next phase of the proposal.

The landowners will be fully responsible for the repair and management of the implemented SuDS throughout the lifetime of the proposed development.

The development will not give rise to backwater affects or divert water towards other properties.

This report demonstrates that the proposal will be safe, in terms of flood risk, for its design life and will not increase the flood risk elsewhere.

# Appendix A Collection of Flood Maps and Figures

# Appendix B Existing Site and Proposed Plans

# Appendix C Environment Agency's Data and Information