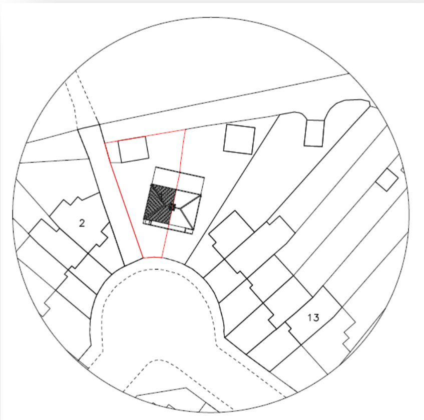
Colneside

Building Design Consultancy

FLOOD RISK ASSESSMENT

1 Lynhurst Crescent, Uxbridge, UB10 9EF

Demolition of existing single storey rear extension & construction of part single/two storey side/rear extensions with associated internal alterations.



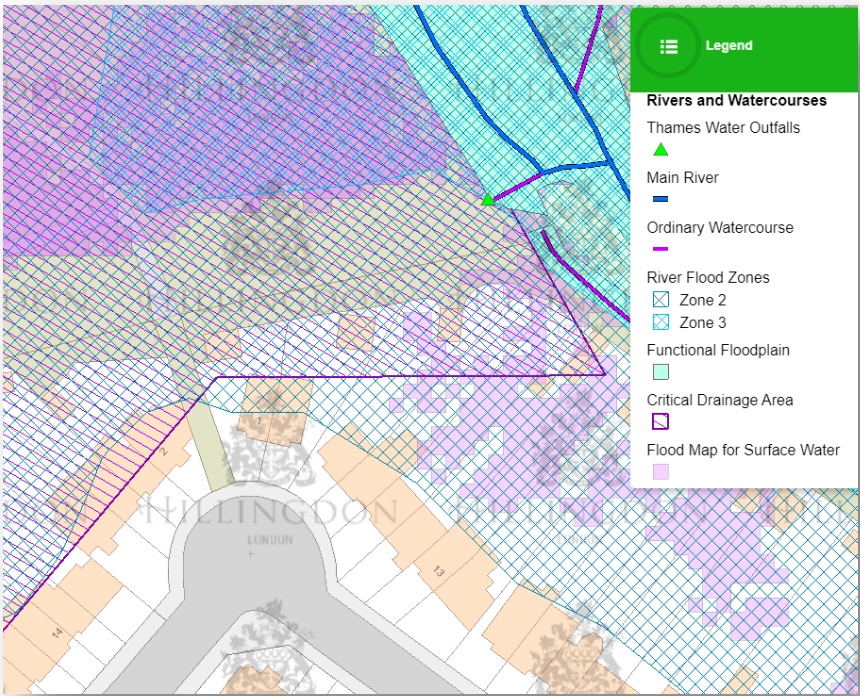
November 2024

INTRODUCTION

A Flood Risk Assessment, also known as an FRA, is a report that details the main flood risks to a development site. It can also provide recommendations for mitigating measures to alleviate the impact of flooding to the site and surrounding area.

DEVELOPMENT SITE & LOCATION

1 Lynhurst Crescent, Uxbridge, UB10 9EF is located in the London Borough of Hillingdon with an Easting/Northing of 508393/184431. The site is approximately 250 square meters in area and is currently of a Residential Use. The site is located in Flood Zone 2. The following map is the strategic Flood Risk Assessment Map for the area from LB Hillingdon.



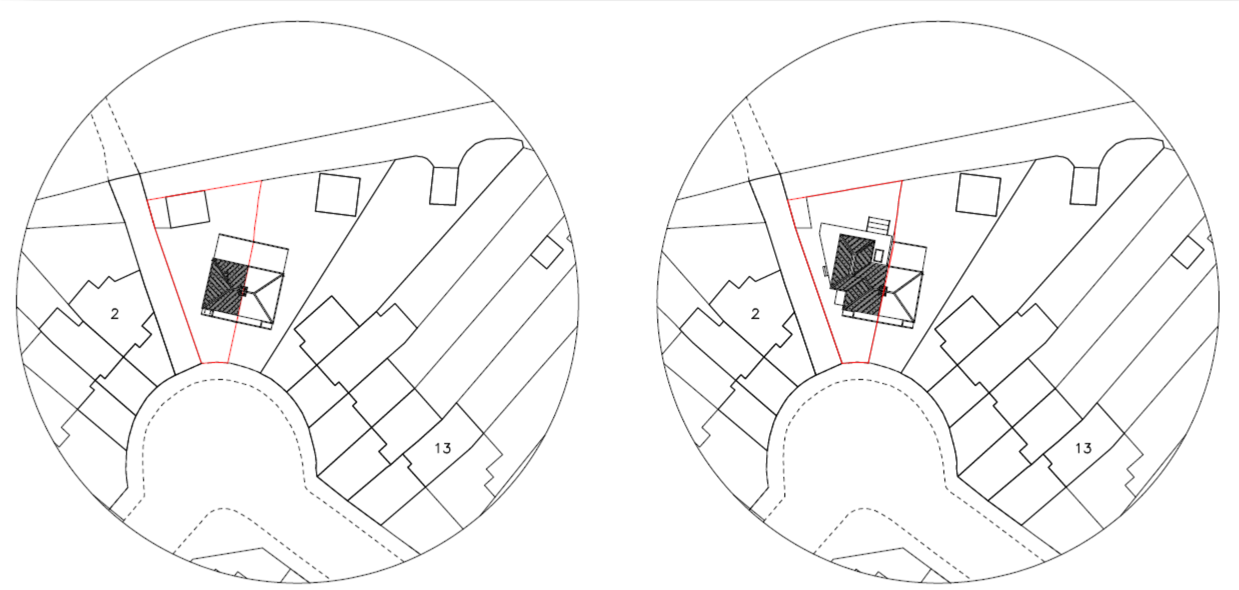
Strategic Flood Risk Map – Author of map content London Borough of Hillingdon

DEVELOPMENT PROPOSAL

Residential developments should be considered for a minimum of 100 years, unless there is specific justification for considering a shorter period. For example; the time in which flood risk or coastal change is anticipated to impact on it, where a development is controlled by a time-limited planning condition.

The proposed development is likely to have an expected lifetime of between 50-100 years and consists of:

'Demolition of existing single storey rear extension & construction of part single/two storey side/rear extensions with associated internal alterations'.



In terms of vulnerability to flooding the vulnerability classification for the proposal can be seen in the following Table (1).

TABLE 1

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

SEQUENTIAL TEST

The aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

- **As the proposed development cannot be relocated to another site and the proposal has been determined as a 'minor' development a Sequential Test is not applicable but will still meet the requirements for a site-specific flood risk assessment.**

EXCEPTION TEST

The application of an exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage.

For the exception test to be passed it should be demonstrated that:

(a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

(b) 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.

- **As the proposed development is a 'minor' development and not Highly vulnerable as shown in the following report an Exception Test is not applicable but will still meet the requirements for a site-specific flood risk assessment.**

SITE SPECIFIC FLOOD RISK

A site specific appraisal provides an understanding of the particular risks of flooding the site. Potential impacts to the development including what effects it may have elsewhere on flood risk are set out in a FRA report in accordance with NPPF guidance.

The proposed development site lies within Flood Zone 2 with the main risk of flooding coming from Yeading Brook (fluvial source). The site is also at potential risk from surface water flooding.

Environment Agency

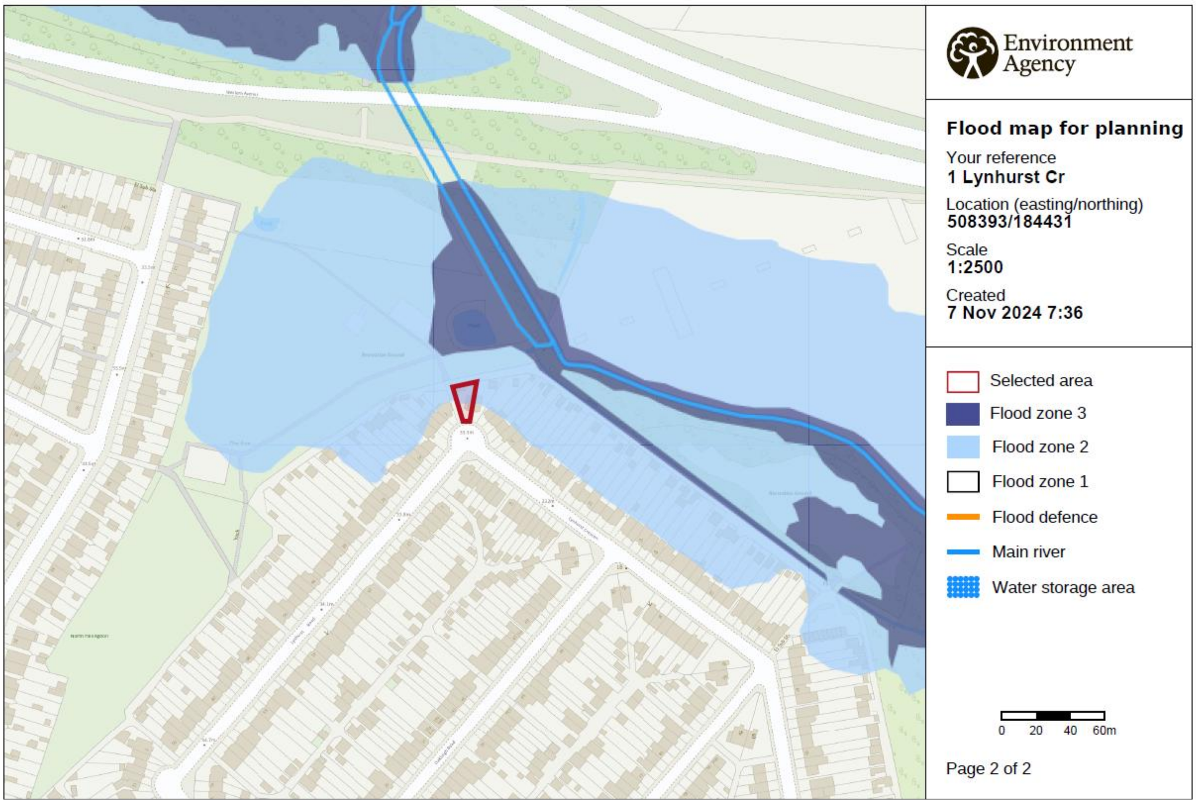
Flood map for planning

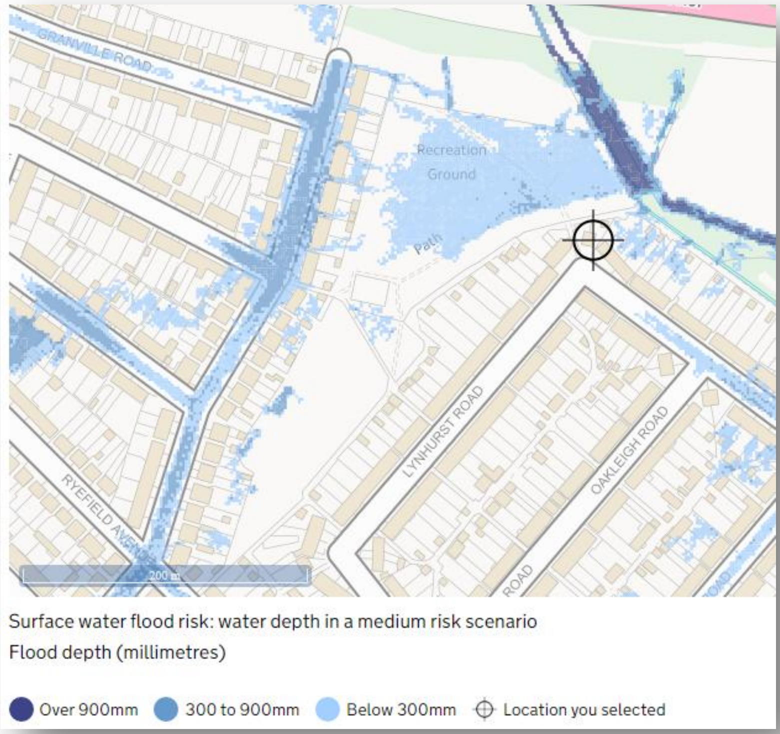
Your reference	Location (easting/northing)	Created
1 Lynhurst Cr	**508393/184431**	**7 Nov 2024 7:36**

Your selected location is in flood zone 2, an area with a medium probability of flooding.

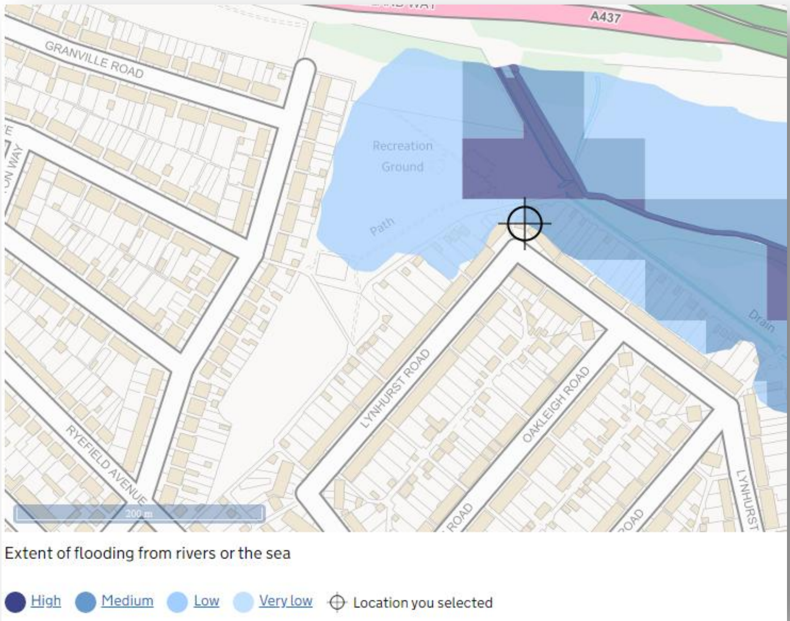
This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

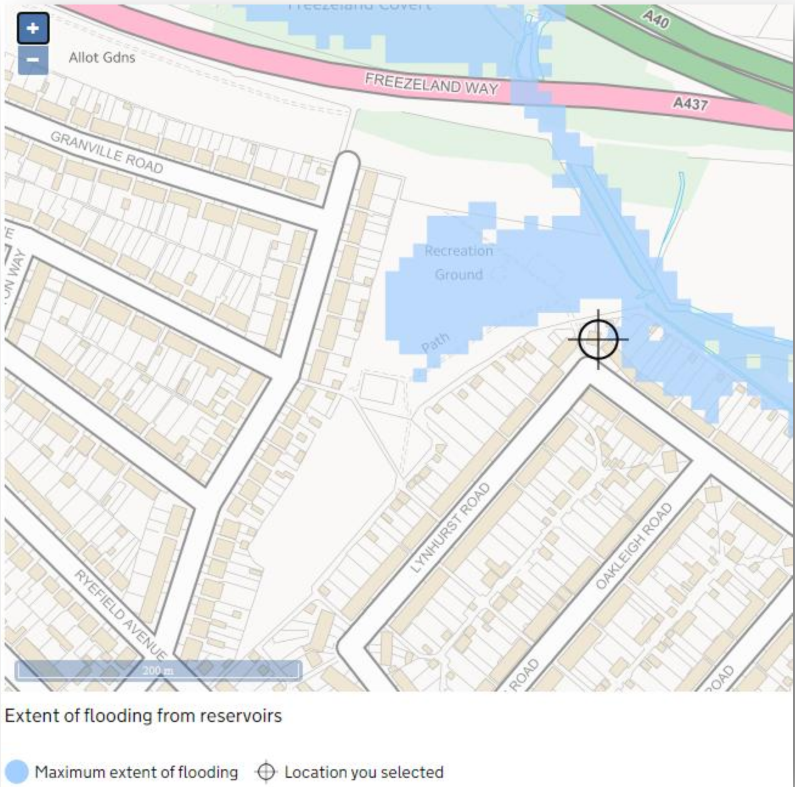




Map confirms below 300mm flood depth (mm) of surface water flood risk



Map confirms Very Low risk of flooding from rivers/seawater flood risk



Map confirms no risk of flooding from reservoirs

Map confirms a Medium risk of flooding from surface water

CLIMATE CHANGE

Climate change allowances are predictions of anticipated change for:

- peak river flow
- peak rainfall intensity
- sea level rise
- offshore wind speed and extreme wave height

To increase resilience to flooding and coastal change, if required allowances for climate change should be included within a flood risk assessment.

Peak river flow allowances

Peak river flow allowances show the anticipated changes to peak flow by river basin district. The:

- central allowance is based on the 50th percentile
- higher central allowance is based on the 70th percentile
- upper end allowance is based on the 90th percentile

An allowance based on the 50th percentile is exceeded by 50% of the projections in the range. At the 70th percentile it is exceeded by 30%. At the 90th percentile it is exceeded by 10%.

Which peak river flow allowance is to be used for the assessment?

The following map confirms the development is within the Thames river basin district:

Peak river flow allowances by river basin district (based on a 1961 to 1990 baseline)

River basin district	Allowance category	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)
Thames	H++	25%	40%	80%
	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%

- **The site appears to be within the less vulnerable classification so the higher central allowance is recommended. This allows the basis for designing safe access, escape routes and places of refuge. This will ensure the safety of people using the development.**

Floodplain storage compensation

The central allowance for floodplain storage compensation will be adhered to as the affected area contains only low vulnerability uses and will be of a water compatible development.
The appropriate allowance to assess off-site impacts and calculate floodplain storage compensation depends on land uses in affected areas. In most cases use the higher central allowance to calculate floodplain storage compensation.

Peak rainfall intensity allowance

Increased rainfall affects river levels and land and urban drainage systems.

Table 2 shows anticipated changes in peak rainfall intensity in small catchments (less than 5km^2), or urbanised drainage catchments. For large rural drainage catchments use the allowances in table 1.
For flood risk assessments and strategic flood risk assessments, assess both the central and upper end allowances to understand the range of impact.

Table 2: peak rainfall intensity allowance in small catchments (less than 5km^2) or urban drainage catchments (based on a 1961 to 1990 baseline)

Applies across all of England	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)
Upper end	10%	20%	40%
Central	5%	10%	20%

- **The proposed drainage system will be designed to make sure there is no increase in the rate of runoff discharged from the site for the upper end allowance. The floor level is 600mm above ground level and the external render starts 75mm above this level.**
- **There will be no significant flood hazard to people from on-site flooding.**

Sea level allowances

For this flood risk assessment both the higher central and upper end allowance will be considered. Table 3: sea level allowances by river basin district for each epoch in mm per year (based on a 1981 to 2000 baseline) – the total sea level rise for each epoch is in brackets

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
South east	Higher central	5.7 (200)	8.7 (261)	11.6 (348)	13.1 (393)	1.20
South east	Upper end	6.9 (242)	11.3 (339)	15.8 (474)	18.2 (546)	1.60

The allowances in table 3 account for slow land movement. This is due to 'glacial isostatic adjustment' from the release of pressure at the end of the last ice age. The northern part of the UK is slowly rising and the southern part is slowly sinking. This is why net sea level rise is less for the north-west and north-east than the rest of the country.

To calculate sea level using table 3, add the allowances for the appropriate one of the 6 geographical areas:

- up to 2035, use the mm per year rates for the appropriate geographical area, starting from the present day extreme sea levels from Coastal design sea levels – coastal flood boundary extreme sea levels (2018)
- from 2036 to 2065, get the increase in sea level by adding the number of years on from 2035 (to 2065), multiplied by the respective rate shown in table 3 for the appropriate geographical area – if the whole time period applies use the cumulative total
- treat time periods 2066 to 2095 and 2096 to 2125 as you would 2036 to 2065

Coastal erosion

Below is a costal erosion risk map in relation to the proposed development which is used to plan for any changes in the position of the coastline, together with any designated coastal change management areas and relevant policies in local plans.

- **The location of the proposed development will not be effected by a costal erosion**

Offshore wind speed and extreme wave height allowance

Wave heights may change because of:

- increased water depths
- changes to the frequency, duration and severity of storms

Offshore wind speed and extreme wave height allowance (based on a 1990 baseline)

Applies all around the English coast	2000 to 2055	2056 to 2125
Offshore wind speed allowance	5%	10%
Offshore wind speed sensitivity test	10%	10%
Extreme wave height allowance	5%	10%
Extreme wave height sensitivity test	10%	10%

- **The location of the proposed development will not be effected by offshore wind speed or extreme wave height**

Storm surge

The present day extreme sea levels in Coastal design sea levels – coastal flood boundary extreme sea levels (2018) account for storm surge. Most Environment Agency coastal models use these extreme sea levels.

- **The location of the proposed development will not be effected by a costal storm surge**

How to use a range of allowances to assess flood risk

To help you decide which allowances to use to address flood risk for a development or development plan allocation, consider the:

- likely depth, extent, speed of onset, velocity and duration of flooding for each allowance of climate change over time
- vulnerability of the proposed development types or land use allocations to flooding
- 'built in' measures used to address flood risk, for example, raised floor levels capacity or space in the development to include measures to manage flood risk in the future, using an adaptive approach

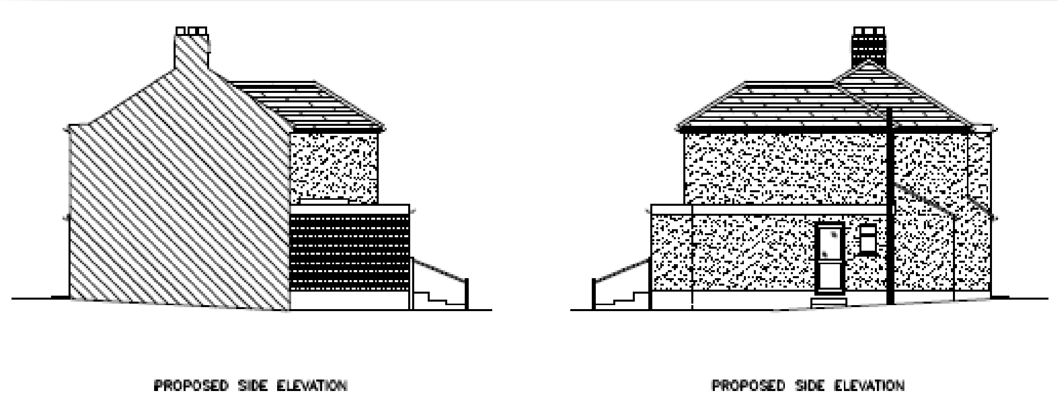
FLOOD RISK MANAGEMENT

FLOOD CONTROL MEASURES

The property is located in an area with a medium probability of flooding.
The existing Surface Water from the property drains into the combined foul/surface water drainage system.

All new surface water pipes will be connected to a Soakaway which will be a minimum of 1.2m^3 capacity measured below the invert level of the inlet pipe. They are to be 'Stormcell' boxes wrapped in a suitable geotextile and positioned not less than 6.0m from any building. The capacity of the soakaway to be based on the effective area being drained. The capacity is to be calculated as 1.2m^3 for every 16m^2 of effective area being drained.

The finished floor level is found 600mm above the external ground level with a suspended Beam & Block Flooring System and External Render starting 75rmm above the Internal Finished Floor Level.



FLOOD MITIGATION MEASURES

General advice for resilient design

Ground supported floors are the preferred option and concrete slabs of at least 150mm thickness should be specified for non-reinforced construction. Hollow slabs are not suitable if the elements are not effectively sealed.

Suspended floors may be necessary where ground supported floors are not suitable, namely in shrinkable/expanding soils (e.g. clay) or where the depth of fill is greater than 600mm. Uplift forces caused by flood water may affect the structural performance of a floor. Suspended floors are generally not recommended in flood-prone areas, for the following reasons:

- the sub-floor space may require cleaning out following a flood, particularly a sewer flood. In order to aid this process and where accumulation of polluted sediment is expected, the sub-floor space should slope to an identified area and be provided with suitable access
- if cleaning is required, floor finishes may need to be removed to provide access to the sub-floor space. Cheaper, sacrificial, finishes would be the best option.
- the steel reinforcement in the concrete beams of 'beam and block' floors may be affected by corrosion and its condition may need to be assessed following repeated or prolonged floods.

Suspended timber floors, particularly when including timber engineered joists, are not generally recommended in flood prone areas because most wooden materials tend to deform significantly when in contact with water and therefore may require replacement. Rapid drying can also cause deformation and cracking.

Reinforced concrete floors are acceptable but may be prone to corrosion of any exposed steel in areas of prolonged flooding.

Hardcore and blinding: good compaction is necessary to reduce the risk of settlement and consequential cracking.

Damp Proof Membranes (d.p.m.) should be included in any design to minimise the passage of water through ground floors. Impermeable polythene membranes should be at least 1200 gauge to minimise ripping. Effective methods of joining membrane sections are overlaps of 300mm, and also taping (mastic tape with an overlap of 50mm minimum). Care should be taken not to stretch the membrane in order to retain a waterproof layer. Experience in Scotland has indicated that welted joints in the d.p.m. are an effective jointing solution.

Insulation materials: Water will lower the insulation properties of some insulation materials. Floor insulation should be of the closed-cell type to minimise the impact of flood water. The location of insulation materials, whether above or below the floor slab, is usually based on either achieving rapid heating of the building or aiming for more even temperature distribution with reduced risk of condensation. Insulation placed above the floor slab (and underneath the floor finish) rather than below would minimise the effect of flood water on the insulation properties and be more easily replaced, if needed. However, water entry may cause insulation to float (if associated with low mass cover) and lead to debonding of screeds.

No firm guidance can be provided on best location for insulation where the primary source of flooding is from groundwater. For other types of flooding, placing insulation below the floor slab may be adequate but it is important to recognise that the characteristics of the insulation may be affected by the uplift forces generated by the flood water.

Floor finishes: suitable floor finishes include ceramic or concrete-based floor tiles, stone, and sand/cement screeds. All tiles should be bedded on a cement-based adhesive/bedding compound and water resistant grout should be used. Concrete screeds above polystyrene or polyurethane insulation should be avoided as they hinder drying of the insulation material. Suitable materials for skirting boards include ceramic tiles and PVC. Ceramic tiles are likely to be more economically viable and environmentally acceptable.

Floor sump: provision of a sump and small capacity automatic pump at a low point of the ground floor is recommended in cases where the expected probability of flooding in any one year is 20% or a frequency of flooding of more than once in five years. This system will help the draining process and speed up drying but it may only be effective for shallow depth flooding. The dimensions of the sump and its operational procedure would be calculated and agreed with the planning authority based on the predicted volumes of water to be drained.

Services: under floor services using ferrous materials should be avoided.

Water entry strategy

General advice for resilient design

Materials that retain their integrity and properties when subjected to flood water (such as concrete) or those that can be easily replaced (sacrificial materials), should be specified. Construction should allow easy access for cleaning, (e.g. below suspended floors), and drainage.

Concrete ground-supported floors are the preferred option and concrete slabs of at least 100mm thickness should be specified.

Suspended floors may be necessary where ground-supported floors are not suitable, namely in shrinkable/expanding soils (e.g. clay soils) or where the depth of fill is greater than 600mm. In cases of prolonged floods, where flood water is heavily silted, or from sewer flooding, the sub-floor space may require cleaning out following a flood; to aid this process, it should slope to an identified low point and be provided with suitable access. If cleaning is required, floor finishes may need to be removed to provide access to the sub-floor space and therefore cheaper, sacrificial, finishes would be the best option. Alternatively, external access to the sub-floor space can be considered as a design option.
Suspended steel floors may be adequate provided they incorporate resilient features such as anticorrosion properties and comply with required structural capability.
Suspended timber floors, particularly when including timber engineered joists, are not generally recommended in flood prone areas because most wooden materials tend to deform significantly when in contact with water and therefore may require replacement. Rapid drying can also cause deformation and cracking.

Hardcore and blinding: good compaction should be achieved to reduce the risk of settlement and consequential cracking.

Damp Proof Membranes (d.p.m.) should be included in any design to minimise the passage of water through ground floors. Impermeable polythene membranes should be at least 1200 gauge to minimise ripping. Effective methods of joining membrane sections are: overlaps of 300mm or taping with mastic tape with an overlap of 50mm minimum. Care should be taken not to stretch the membrane in order to retain a waterproof layer. Experience in Scotland has indicated that welted joints in the d.p.m. are an effective jointing solution but the quality of the welts is very dependent on workmanship.

Insulation materials: Water will lower the insulation properties of some insulation materials. Floor insulation should be of the closed-cell type to minimise the impact of flood water. The location of insulation materials, whether above or below the floor slab, is usually based on either achieving rapid heating of the building or aiming for more even temperature distribution with reduced risk of condensation. It is recommended that insulation be placed above the floor slab (and underneath the floor finish) rather than below would minimise the effect of flood water on the insulation properties and be more easily replaced, if needed.

Floor finishes: there are two possible approaches that depend on an assessment of the likely frequency of flooding and cost of material and installation: use of sacrificial materials or reliance on high quality durable materials.
Sacrificial floor finishes can include timber flooring and soft furnishings such as carpets. Materials that are likely to withstand exposure to floodwater without significant deterioration are ceramic or concrete-based floor tiles, marble or stone. All tiles should be set on a bed of sand and cement render and water resistant grout should be used.
Concrete screeds above polystyrene or polyurethane insulation should be avoided as they hinder drying of the insulation material due to the relative impermeability.
Suitable materials for skirting boards include ceramic tiles and PVC. Ceramic tiles are likely to be more economically viable and environmentally acceptable. Replacement timber may be a suitable option, for cases where a strategy to use of sacrificial materials is adopted.

Floor sump: provision of a sump and small capacity pump in the floor at a low point of the ground floor is recommended in cases where the expected frequency of flooding is high; this system will help the draining process and speed up drying but it may only be effective for shallow depth flooding. The dimensions of the sump and its operational procedure would be calculated and agreed with the Planning Authority based on the predicted volumes of water to be drained.

Services: under floor services using ferrous materials should be avoided

Water exclusion strategy

This strategy is applicable to design flood depths of up to 0.3m or up to 0.6m, if allowed by the structural assessment of the design.

General advice for resilient design

Masonry walls: Ensure mortar joints are thoroughly filled to reduce the risk of water penetration. If frogged bricks are used, they should be laid frog up so that filling becomes easier and coverage more certain. Bricks manufactured with perforations should not be used for flood resilient design.

Where possible, use engineering bricks up to predicted flood level plus one course of bricks to provide freeboard (up to maximum of 0.6m depth above floor level); this will increase resistance to water penetration. Blocks (and dense facing bricks) have much improved performance when covered with render.

Aircrete blocks allow less leakage than typical concrete blocks but concrete blocks dry more quickly. Therefore, design of blockwork walls needs to take into account these two opposite types of behaviour and consider whether drying or resistance to water is most relevant in each situation. For a “water exclusion strategy”, the expected amount of leakage is minimal and therefore, Aircrete blocks are recommended, although they may retain moisture for longer than concrete blocks, Compared with heavier blocks, Aircrete may offer less restraint to floor/slab edges which under the action of uplift forces could promote the opening up of floor/wall junctions.

Do not use highly porous bricks such as hand made clay bricks.

Solid masonry walls are a good option but will need to be fitted with internal or external wall insulation in order to comply with Building Regulations.
Clear cavity walls, i.e. with no insulation in the cavity, have better flood resilience characteristics than filled or part filled cavity walls as they dry more quickly. The requirements for insulation can be satisfied by external insulated renders or internal thermal boards.

There is evidence that thin layer mortar construction (or thin joint, as it is also commonly known) is a good flood resilience option.

Framed walls: Avoid timber framed walls containing construction materials that have poor performance in floods, for example oriented strand board and mineral fibre insulation. Timber framed walls are not recommended in a "water exclusion strategy". Steel framed walls may offer a suitable alternative option but specialist advice needs to be sought on how to incorporate resilient materials/construction methods in the design, in particular with regard to the insulation.

Reinforced concrete wall/floor construction should be considered for flood-prone areas, i.e. where the frequency of flooding is predicted to be high. This form of construction is effective at resisting forces generated by floodwater and will provide an adequate barrier to water ingress (provided service ducts and other openings into the building are adequately sealed). Design details for this type of construction are beyond the scope of this document.

External renders are effective barriers to water penetration and should be used with blocks (or bricks) at least up to the predicted flood level plus the equivalent of a course of bricks as freeboard. Structural checks may be necessary to ensure stability, because of the external water pressures that could occur for design flood depths above 0.3m. External cement renders with lime content (in addition to cement) can induce faster surface drying.

Insulation:

External insulation is better than cavity insulation because it is easily replaced if necessary.

Cavity insulation should preferably incorporate rigid closed cell materials as these retain integrity and have low moisture take-up. Other common types, such as mineral fibre batts, are not generally recommended as they can remain wet several months after exposure to flood water which slows down the wall drying process. Blown-in insulation can slump due to excessive moisture uptake, and some types can retain high levels of moisture for long periods of time (under natural drying conditions).

Internal linings: Internal cement renders (with good bond) are effective at reducing flood water leakage into a building and assist rapid drying of the internal surface of the wall. The extent to which render prevents drying of other parts of the wall is not currently clear. This may be important, particularly for solid wall construction. This applies also to external renders.

Avoid standard gypsum plasterboard as it tends to disintegrate when immersed in water. Splash proof boards do not necessarily offer protection against flood waters, which may remain for some time and exert pressure on the board.

Anecdotal evidence suggests that internal lime plaster/render can be a good solution. Lime plaster depends on contact with the air to set and harden. Because of this, full strength lime plaster, which typically requires over 6 months, was not possible to test. Consequently, no assurance can be given for its performance. Tests performed when young showed that it crumbles very easily under high water pressure.

Water entry strategy

This strategy is applicable to design flood depths above 0.6m, or above 0.3m if the structural assessment of the design shows that the integrity of the building would be compromised by a "water exclusion strategy".

General advice for resilient design

Ensure high quality workmanship at all stages of construction.

Masonry walls:
Use good quality facing bricks for the external face of cavity walls.
Do not use soft bricks, such as hand made clay bricks, which can easily crumble when subjected to water.
Concrete blocks dry more quickly than Aircrete blocks. However, Aircrete blocks allow less leakage. Therefore, design of blockwork walls needs to take into account these two opposite types of behaviour and consider whether drying or resistance to water is most relevant in each situation. For a "water entry strategy" which is aimed at allowing water passage through the property, concrete blocks are recommended.
Clear cavity walls, i.e. with no insulation, have better resilience characteristics than filled or part filled cavity walls as they dry more quickly.

Framed walls: Avoid timber framed walls containing construction materials that have poor performance in floods, namely oriented strand board and mineral fibre insulation. Timber framed walls are generally not recommended, unless a sacrificial approach is adopted whereby some materials will be stripped to allow drying.

Steel framed walls may offer a suitable alternative option but specialist advice needs to be sought on how to incorporate resilient materials/construction methods in the design. The possible use of bituminous paint on steel plates may be a means of preventing corrosion.

External renders should not be used as they provide a barrier to water penetration and may induce excessive differences in depth between outside and inside of the property resulting in possible structural problems.

Insulation: External insulation is better than cavity insulation because it is easily replaced if necessary; however it is generally protected by rigid lining which may create a barrier to water.

Cavity insulation should incorporate rigid closed cell materials as these retain integrity and have low moisture take-up. Other common types, such as mineral fibre batts, are not generally recommended as they can remain wet several months after exposure to flood water which slows down the wall drying process. Blown-in insulation can slump due to excessive moisture uptake, and some types can retain high levels of moisture for long periods of time (under natural drying conditions).

Internal linings:
Avoid internal cement renders as these can prevent effective drying.
Use standard gypsum plasterboard up to the predicted flood level (plus freeboard of 50mm) as a sacrificial material. For this purpose, the use of a dado rail to separate the above and below flooded area may be useful. Splash proof boards do not necessarily offer better protection against flood waters, which may remain for some time and exert pressure on the board.
Above predicted flood level (plus freeboard) the use of plasterboard or internal cement renders is appropriate.

Anecdotal evidence suggests that internal lime plaster/render can be a good solution. Lime plaster depends on contact with the air to set and harden. Because of this, full strength lime plaster, which typically requires over 6months, was not possible to test. Consequently, no assurance can be given for its performance. Tests performed when young showed that it crumbles very easily under high water pressure.

Doors and windows

Doors, windows and air vents are potential flow paths into properties.

General advice for resilient/resistant design

Doors: Raising the threshold as high as possible, while complying with level access requirements, should be considered as the primary measure. In addition, sealed PVC external framed doors should be used and, where the use of wooden doors is a preferred option, all effort should be made to ensure a good fit and seal to their frames.

Hollow core timber internal doors should not be used where the predicted frequency of flooding is high. Where sufficient flood warning is given, butt hinges, that allow internal doors to be easily removed and stored in dry areas prior to a flood, should be used. Where the frequency of predicted flooding is low or where there is no warning (e.g. overland or sewer flooding) it may be necessary to replace the doors after the flood.

Windows/patio doors: Windows and patio doors are vulnerable to flood water and similar measures to those used for doors should be taken. Special care should be taken to ensure adequate sealing of any PVC window/door sills to the fabric of the house. Of particular concern would be excessive water pressure on the glazing of patio doors. Double glazing conforming to the relevant standards would in principle adequately resist the pressures generated by flood waters; debris carrying flows may cause damage.
Air vents: special designs of air vent are available in the market to prevent water ingress in circumstances where the predicted flood depth is low (i.e. < 0.3m); e.g. periscopic air vent. Careful consideration should be given to effectively sealing any associated joints.

Fittings

Water exclusion strategy

General advice for resilient design

The main principle is to use durable fittings that are not significantly affected by water and can be easily cleaned (e.g. use of plastic materials or stainless steel for kitchen units). The cost of these units may need to be balanced against the predicted frequency of flooding.

Place fittings (e.g. electrical appliances, gas oven) on plinths as high as practicable above floor so that they are out of reach of flood water.

Ensure adequate sealing of joints between kitchen units and surfaces to prevent any penetration of water behind fittings.
Ensure high quality workmanship in the application of fittings.

Water entry strategy

General advice for resilient design

Although a sacrificial approach can be adopted whereby fittings are designed to be replaced after a flood, it is advisable to specify durable fittings that are not appreciably affected by water and can be easily cleaned (e.g. use of plastic materials or stainless steel for kitchen units). The cost of these units may need to be balanced against the predicted frequency of flooding. Avoid wood fibre based carcases and use easily removable solid wood doors and drawers.

Place fittings (e.g. electrical appliances, gas oven) as high as practical above floor to minimise the risk of being affected by flood water.

When allowing water in, it is important to provide means for effective drainage and cleaning. Providing gaps behind kitchen units will facilitate drainage and will allow access for forced drying, if proved to be necessary.

Ensure high quality workmanship in the application of fittings.

Services

General advice for resilient design

Where possible, all service entries should be sealed (e.g. with expanding foam or similar closed cell material).

Pipework: Closed cell insulation should be used for pipes which are below the predicted flood level.

Drainage services: Non-return valves are recommended in the drainage system to prevent back-flow of diluted sewage in situations where there is an identified risk of the foul sewer surcharging. Maintenance of these valves is important to ensure their continued effectiveness.

Water, electricity and gas meters: should be located above predicted flood level.

Electrical services: electrical sockets should be installed above flood level for ground floors to minimise damage to electrical services and allow speedy re-occupation. Electric ring mains should be installed at first floor level with drops to ground floor sockets and switches.

Heating systems: boiler units and ancillary devices should be installed above predicted flood level and preferably on the first floor of two-storey properties. Underfloor heating should be avoided on ground floors and controls such as thermostats should be placed above flood level. Conventional heating systems, e.g. hot water pipes are unlikely to be significantly affected by flood water unless it contains a large amount of salts. The less common, hot air duct heating would remain effective provided it is installed above the design flood level.

Communications wiring: wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage. Any proposed design solution for flood insulation on all potentially vulnerable wiring should be discussed with the relevant service providers.

CONCLUSIONS

The property is located in an area with a medium probability of flooding.

The existing Surface Water from the property drains into the combined foul/surface water drainage system.

- As the proposed development cannot be relocated to another site and the proposal has been determined as a 'minor' development a Sequential Test is not applicable but will still meet the requirements for a site-specific flood risk assessment.
- As the proposed development is a 'minor' development and not Highly vulnerable as shown in the following report an Exception Test is not applicable but will still meet the requirements for a site-specific flood risk assessment.
- There will be no significant flood hazard to people from on-site flooding.
- The location of the proposed development will not be effected by a costal erosion
- The location of the proposed development will not be effected by offshore wind speed or extreme wave height
- The location of the proposed development will not be effected by a costal storm surge
- All new surface water pipes will be connected to a Soakaway which will be a minimum of $1.2m^3$ capacity measured below the invert level of the inlet pipe. They are to be 'Stormcell' boxes wrapped in a suitable geotextile and positioned not less than 6.0m from any building. The capacity of the soakaway to be based on the effective area being drained. The capacity is to be calculated as $1.2m^3$ for every $16m^2$ of effective area being drained.
- The finished floor level is found 600mm above the external ground level
- The proposed floor will be of a suspended Beam & Block (concrete) Flooring System
- The External Render starting 75rmm above the Internal Finished Floor Level.
- Waterproof coatings should be used.
- Electrics should be fed from the ceiling to switch points and sockets should be set a metre above the floor level .
- Any pipework under the extension should not be of metal to avoid corrosion taking place.
- More detailed information is provided with the government document "Improving the flood performance in new buildings"