London Borough of Waltham Forest

LOCAL FLOOD RISK MANAGEMENT STRATEGY

Adoption Version

April 2015
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# LBWF Local Flood Risk Management Strategy

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1 Introduction

1.1 The Government has recently given local authorities new powers to manage local flood risk in a more co-ordinated way. As a ‘Lead Local Flood Authority’, the Council's responsibilities relate to ‘local’ flood risk from surface water, groundwater and small rivers, streams and ditches. Flooding from main rivers remains the responsibility of the Environment Agency.

1.2 As a ‘Lead Local Flood Authority’ it is a legal requirement under the Flood and Water Management Act (2010) that we produce a Local Flood Risk Management Strategy that:

- Provides an overview of flood risk management work being undertaken and planned throughout the borough;
- Outlines how we are working with partners to reduce flood risk;
- Clearly sets out which organisations are responsible for different types of flooding in the borough;
- Is in accordance with the National Flood and Coastal Erosion Management Strategy.

1.3 The rise in extreme weather conditions, the presence of existing buildings in areas of flood risk, and limited public funding, means that we cannot stop all flood incidents happening in the borough. However, through the strategy we can co-ordinate services so that flood risk is reduced and the aftermath of any flood incidents is minimised. The strategy also provides us with an opportunity to work with local residents and businesses to minimise risk and prepare for the effects of climate change.

1.4 The strategy has been subject to public consultation, the details of which are set out in the accompanying Consultation Statement. The environmental impacts of the strategy have also been assessed in the form of a supporting Strategic Environmental Assessment. The strategy will be kept under review and refreshed as appropriate in light of new legislation, flooding data, and planned flood alleviation measures.
2 Partner responsibilities

2.1 Several organisations have a role to play in minimising the risk and impact of flooding in the borough. The strategy will set out the responsibilities of such organisations so it is clear how they will work together and so that local residents and businesses know what to expect of them. Alongside the Council, key organisations include:

- **The Environment Agency** - has a strategic overview of all sources of flooding and coastal erosion (as defined in the Flood and Water Management Act 2010). It is also responsible for flood and coastal erosion risk management activities on main rivers and the coast, regulating reservoir safety, and working in partnership with the Met Office to provide flood forecasts and warnings. It must also look for opportunities to maintain and improve the environment for people and wildlife while carrying out all of its duties. Managing flood risk in the Lower Lee Valley catchment, today and in the future (2013), sets out proposals for managing flood risk in Waltham Forest (and the wider Lower Lee Valley catchment), including:
  - continued maintenance of the Flood Relief Channel;
  - investigation of potential flood alleviation measures for the Ching Brook, and increased flood warnings;
  - desilting the Dagenham Brook to maintain its flow capacity.

- **Water and Sewerage Companies** - these are responsible for managing the risks of flooding from surface water and foul or combined sewer systems providing drainage from buildings and yards.
Neighbouring London Borough's of Enfield, Tower Hamlets, Haringey, Hackney and Newham, and London Legacy Development Corporation - London boroughs are working together through the Drain London Forum to share knowledge and agree where possible a common approach to flood risk management. Regular meetings are held between the 6 boroughs, Thames Water and the Environment Agency to discuss group wide issues and share best practice. The London Legacy Development Corporation are also included here as they are the local planning authority for the Olympic Park area, which includes part of Waltham Forest.

Emergency Services - responsible for minimising the impact of extreme flood events and responding to emergency situations. The Council's Civil Contingencies team works in partnership with such authorities to ensure a coordinated multi-agency response to flood events. For example, an event was held in December 2013 where Council staff and representatives from the Metropolitan Police, Fire Brigade and Ambulance Service met, along with other specialist advisors such as the local NHS Trust, Environment Agency and Thames Water, to clarify different organisations responsibilities in the event of a flood. Details of different organisations responsibilities in the event of a flood, as set out in the Multi Agency Flood Plan, which is available upon request. Within the Multi Agency Flood Plan, the emergency services responsibilities focus on saving lives, evacuation of flooded properties and providing treatment and care to those affected, and warning and informing the public of flooding events.

Developers - have a responsibility to minimise flood risk in new developments and their impact on the surrounding areas, through the design and layout of their schemes and incorporation of SuDS techniques. Section 7: Case Studies provide some examples of how these are being incorporated into recently permitted schemes.
2.2 Although they are not a ‘Risk Management Authority’ as defined by the Flood and Water Management Act, the Greater London Authority have a co-ordination role for all 33 London Boroughs. They co-ordinate Drain London work to help manage and reduce surface water flood risk in London by improving available knowledge of the surface water drainage system and identifying areas at the greatest risk of flooding. Through this role, they also demonstrate some of the ways to reduce the risk.

2.3 Local residents and businesses also have a role to play in managing flood risk. People and properties in any known areas of flood risk should be prepared for flood incidents, and any landowners whose properties adjoin watercourses have a responsibility to ensure the unobstructed flow of water. In addition, it is essential that local residents and businesses report any incidents of flooding of property, open spaces and roads. This all helps to build up knowledge of patterns of flooding; which can then help with future risk management. Flooding incidents can be reported to the Council by telephone (0208 496 3000), email (wfdirect@walthamforest.gov.uk), or online (https://www.walthamforest.gov.uk/Pages/OnlineForms/flooding-or-gully-problem.aspx)

3 What do we know about flooding in the borough?

3.1 The Council has a responsibility to investigate and publish reports on major flooding incidents, and to maintain a register of flood management assets. Recent history indicates most flooding incidents in the borough have been of small scale floods of highways, footways, and some basements of private properties. Currently we investigate all reported flooding incidents, with the detail of any reports proportionate to the nature and extent of the flooding incident. If there is a substantial increase in reported incidents of flooding in the future, there may be a need to prioritise the investigation of floods affecting properties.
3.2 We also have a statutory duty to carry out a range of technical studies, which have helped enhance our understanding of flood risk in the borough. These studies include:

- **A Preliminary Flood Risk Assessment** - a high level study on all types of flooding in the borough, including a summary of historic significant floods, and information on future flood risk based on Environment Agency data.

- **A Strategic Flood Risk Assessment** - a tool used to inform the policies and site allocations in our planning documents to ensure future developments are sited and designed to minimise future flood risk.

3.3 In addition, whilst we do not have a statutory duty to produce, our Surface Water Management Plan provides a strategy to manage flooding from sewers, drains, groundwater, and runoff from land, small water courses and ditches that occur as a result of heavy rainfall.

3.4 The main source of flood risk in Waltham Forest is fluvial flooding associated with the Lower Lea, its tributaries and associated diversion channels. Although the River Lee is no longer tidal, its lower reaches of the River Lee have a tidal influence from the River Thames because the River Lee is 'tide locked' at high tide by Three Mills Lock. This can lead to an increase in water levels in the River Lee and Dagenham Brook. Figure 1 below shows Flood Zone 3b as defined in our Strategic Flood Risk Assessment as well as Flood Zones 2 and 3a designated by the Environment Agency based on risk of fluvial and tidal flooding. This represents a grading of flood risk, with zone 3b being the most vulnerable areas. These zones are used to influence decisions on what types of new development can be located where. In addition, figure 2 outlines the locations of historical surface water flooding.
Figure 1 Environment Agency Flood Zones
3.5 The River Lea flows south along the western boundary of Waltham Forest with the River Lea Flood Relief Channel (figure 3) located to the east of it. The Dagenham Brook (figure 4) and Ching Brook (figure 5) are tributaries of the River Lea, and flow through urban areas, often within culverts.

Figure 3 River Lee Flood Relief Channel
3.6 The River Lea, its flood relief channel, The Ching Brook, and the Dagenham Brook are all classified as ‘main rivers’ and as such the Environment Agency has powers to undertake maintenance, carry out improvement works, and to issue consents for 3rd party works. However, they only have a duty to carry out works where they own structures, which includes some sections of the River Lee Flood Relief Channel, some man-made sections of the Dagenham Brook, and some structures along the Ching Brook; such as trash screens upstream of Walthamstow Stadium.

3.7 In addition to structures in the Environment Agency’s ownership, the Council is in the early stages of compiling a register of all structures that play a significant role in minimising flood risk; known as the register of flood management assets. Producing and maintaining this register is one of our statutory duties as a Lead Local Flood Authority.

3.8 The Flood Relief Channel is a major asset in terms of flood defences, and there have been no major floods in the borough since it became operational in 1976. Having said this, it is known that the flood relief channel almost reached capacity in 1987, 1993, and 2000.
3.9 More localised forms of flooding can be found throughout the borough, in areas identified as critical drainage areas. Full details can be viewed in our Surface Water Management Plan (see www.walthamforest.gov.uk). The areas identified in this document as being most vulnerable from flooding associated with drainage issues are highlighted in figure 6 below.

3.10 Whilst these main critical drainage areas cover a significant amount of the borough, it is important to note that this is based on a cautious approach of looking at potential risk in the event of severe storms when the drainage network cannot cope with abnormally high levels of rainfall. Many of the past floods in the borough have been small scale incidents due to this lack of capacity in the existing drainage network, or blocked gullies preventing them from fulfilling their purpose effectively; combined with the natural topography of the area; i.e. relatively low lying land. Programmes such as regular gully cleaning, and securing Sustainable Drainage Systems (SuDS) in new developments to minimise surface water runoff, will help minimise the risk of localised flooding in the future. Furthermore, the 'Critical Drainage Areas' refer to broad catchment areas, so do not mean every property within the boundary is at a significant level of risk. More detailed maps can be viewed in the Surface Water Management plan at www.walthamforest.gov.uk
Figure 6 Main Critical Drainage Areas
3.11 As tackling flood risk requires a multi-agency approach, studies commissioned by partner organisations can also help aide our understanding of flood risk in the borough. For example Northumberland Park Depot – Fluvial Flood Risk Assessment and Feasibility Report, commissioned by Transport for London/ London Underground, included an assessment of Blackhorse Road Underground Station. This found that the station benefits from a robust level of protection by virtue of its elevation and local topography.

4 Main aims of the strategy

4.1 Based on our understanding of flooding in the borough, the key aims of our Local Flood Risk Management Strategy, to help minimise the impact of flood risk on our residents and businesses, are:

1. **Drainage management strategy** - to develop a long term drainage asset management strategy incorporating highway and watercourse maintenance so that any lack of capacity in the surface water network is dealt with in a co-ordinated rather than reactive manner. It is likely that future modelling of Critical Drainage Areas (see figure 6) will be required to inform such a strategy.

2. **Resilience** - to promote flood resistance and resilience measures to any properties at risk of flooding.

3. **Communications** - to keep local residents and businesses informed of our proposed strategy, any flood management works that will affect them, and to investigate and provide feedback on the causes of reported flooding incidents.

4. **Innovation** - to promote the use of new technologies and innovation in flood mitigation measures.

5. **Sustainable drainage** - to promote the incorporation of Sustainable Drainage Systems (SuDS) into new developments and open space improvement projects, and the retrofitting of such techniques in existing areas of high flood risk. This includes ensuring Sustainable Drainage Systems for run-off management are included in larger developments, secured through the planning system in accordance with statutory requirements.
6. **Environmental improvements** - to ensure that where possible, flood management measures go beyond being merely functional, and secure wider environmental enhancements such as to water quality and biodiversity, in order to meet the objectives of the Water Framework Directive and National Flood and Coastal Erosion Risk Management Strategy.

7. **Funding** - to secure national funding where possible, to manage existing maintenance budgets, and to explore additional funding sources.

**Objectives and Actions**

4.2 The table below sets out our detailed objectives and actions that will help meet our overall aims. It is important to note that as tackling flood risk requires a multi-agency response, not all actions fall under the direct responsibility of the Council, and in many cases partner organisations will play an important role.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Action</th>
<th>Partners</th>
<th>Timeframe</th>
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<tbody>
<tr>
<td>Ensure new developments minimise the risk of flooding</td>
<td>1. Direct new developments away from flood risk areas through application of sequential and exception test</td>
<td>Environment Agency, landowners/developers</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>2. Incorporate SUDs measures into new developments to achieve greenfield runoff rates where possible</td>
<td>Landowners/developers</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>3. Set up and implement an appropriate mechanism for aligning SUDs are</td>
<td>Environment Agency, Thames Water</td>
<td>TBC</td>
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<td></td>
<td>secured on major developments through the planning process</td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td>Ensure domestic vehicle crossings and paving over front gardens use permeable/porous surfacing in accordance with government regulations – see Appendix 1</td>
<td>Landowners</td>
<td>Ongoing</td>
</tr>
<tr>
<td>5.</td>
<td>Developments in Critical Drainage Areas to contribute to measures to reduce surface water flood risk in the Critical Drainage Area</td>
<td>Landowners/developers</td>
<td>Ongoing</td>
</tr>
<tr>
<td><strong>Increase public awareness of flooding issues and promote community level action</strong></td>
<td></td>
<td></td>
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<tr>
<td>6.</td>
<td>Publish and refresh all information on flood risk, how residents/businesses can minimise risk, and what to do in the event of a flood, on the Councils website</td>
<td>Initial publication Dec 2014, to be reviewed and refreshed on a 6 month basis</td>
<td></td>
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<tr>
<td>7.</td>
<td>Create and maintain a register of flood risk assets</td>
<td>2016</td>
<td></td>
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<tr>
<td>8.</td>
<td>Alert and advise local residents and</td>
<td>Environment Agency</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Ensure flood risk management takes account of social, economic, and environmental outcomes</td>
<td>9. Where practical and appropriate, take steps to enhance the natural environment, in relation to flood risk management works</td>
<td>Environment Agency</td>
<td>Ongoing</td>
</tr>
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<tr>
<td>10. Improve water quality in the Dagenham Brook; through dredging works, and correcting householder and business water misconnections</td>
<td>Environment Agency, Thames Water, Landowners</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td>11. Annual clearing of ditches at Overton Road, Chingford Lane, Rangers Road, Oak Hill, Brookfield Path and Leyton Common Sewer (open ditch)</td>
<td></td>
<td>Annually</td>
<td></td>
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<tr>
<td>12. Encourage incorporation of SUDs when conventional</td>
<td>Landowners/developers, Thames Water</td>
<td>Ongoing</td>
<td></td>
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<tr>
<td><strong>Tackle flood risk through a partnership approach</strong></td>
<td>13. Continued attendance at LODEG and Drain London meetings to share best practice with partner authorities and meet obligations under the Floods and Water Management Act</td>
<td>London Boroughs, GLA, Thames Water, Environment Agency</td>
<td>Ongoing</td>
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<tr>
<td><strong>Enhance understanding of flood risk in the borough</strong></td>
<td>15. Prepare a Level 2 Strategic Flood Risk Assessment to inform planning policies</td>
<td>Environment Agency</td>
<td>Completed 2011</td>
</tr>
<tr>
<td>No.</td>
<td>Task Description</td>
<td>Responsible Authority</td>
<td>Duration</td>
</tr>
<tr>
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<tr>
<td>17.</td>
<td>Investigate cause and potential solutions to historic surface water flooding in South Chingford identified by the Surface Water Management Plan and updated Environment Agency surface water flooding maps.</td>
<td>Environment Agency Consultant to be appointed</td>
<td>May 2014-May 2016</td>
</tr>
<tr>
<td>19.</td>
<td>Investigate cause and potential solutions to historic flooding at Sturge Avenue, Walthamstow</td>
<td>Environment Agency Consultant to be appointed</td>
<td>April 2015 – April 2017</td>
</tr>
<tr>
<td></td>
<td>21. Determine standards of protection offered by pumps/ drainage serving critical transport infrastructure underpasses – e.g. A12</td>
<td>Tfl, Thames Water</td>
<td>2015</td>
</tr>
</tbody>
</table>

| Manage the likelihood and impact of flooding | 22. Develop and implement a regular programme of gully cleaning to ensure drainage systems are operating at capacity | JB Riney | Completed June 2013. Programme to be reviewed summer 2015 |
|   | 23. Maintain surface water sewers to ensure drainage systems are operating at capacity | Thames Water | Ongoing |
|   | 24. Investigate reported incidents of flooding and take appropriate action; e.g. gully cleaning/provision of additional gullies, report to Thames Water for drainage network assessment | Thames Water, Transport for London | Ongoing |
5 Funding

5.1 The way that Government funds flood risk management projects changed in 2012. Funding levels for each scheme now relate directly to the number of homes protected, damage prevented, and other benefits such as the environmental or business benefits that will be delivered. Extra emphasis is also now given to protecting homes in deprived areas.

5.2 We will be pursuing a range of available funding opportunities to help reduce flood risk in the borough. In addition to local authority budgets for works on the highways drainage network and maintenance regimes, the strategy will also seek contributions from developers when planning applications are determined.

5.3 In addition, the Council has bid for money from the Flood Defence Grant in Aid (FDGiA) fund to appoint consultants to carry out drainage investigations and prepare scheme proposals for the following areas:

- Fillebrook Surface Water Investigation.
- South Chingford Surface water investigation.
- Chestnuts Showground.

5.4 This funding is part of a national pot that is administered by the Environment Agency. Bids are determined on the basis of the level of risk, with priority given to schemes affecting the highest number of properties, particularly in deprived areas. The areas we are bidding for were identified within the Surface Water Management Plan and through reports of flooding from local residents. Working with the Environment Agency and using their best available data it is estimated that 263 properties in total are at risk from flooding within the 3 areas to be investigated.

6 How will flood risk management schemes be prioritised?

6.1 The level of flood risk varies across the borough and as such any works should be proportionate to the level of risk. They should also seek to go beyond being merely functional (such as the Lee Valley Flood Relief Channel), and consider their impact on the local environment. Where possible this should include their physical appearance and impact on biodiversity.
6.2 In Waltham Forest, local flood risk management schemes will be categorised as follows:

- Schemes in response to reports of flooding incidents from residents and businesses.

- Ongoing programme of drainage improvement and maintenance works. The Council has a gully cleansing contract in place to ensure that a regime exists to maintain the boroughs 18000 plus gullies. This recommends the required cleaning frequency for different categories of gully subject to their classification and priority; i.e. whether they are located within high blockage risk locations, market areas, strategic routes and main distributor roads or residential access roads. The map in Appendix 2 shows the road classification and gully categories designated throughout the borough.

- Introduction of SuDss techniques such as swales, green roofs, storage ponds, water features and permeable paving within new developments through the planning process and inclusion within regeneration projects where public open space is available to include SuDs techniques.

Swale in Upton (source Susdrain, 2012)
Working in partnership with the Environment Agency and Thames Water to improve water quality within the Dagenham Brook and enhance biodiversity. The Council’s Environmental Health team is working with the Environment Agency and Thames Water to identify and address misconconnections within the Borough and the possible inclusion of hydrodynamic separators within any proposed engineering solutions to clean up the Brook.

Possible larger long term schemes with eligibility for national funding.

7 Case Studies

Incorporation of SUDs into new developments

7.1 Recent years have seen a number of key developments come forward where the use of SUDs techniques have been negotiated through the planning process in order to help reduce flood risk as part of the proposed development. This section sets out some examples of techniques used and progress on implementing these.

Waltham Forest Leisure Centre

7.2 SuDS features have been agreed through the planning process to capture and cleanse rainwater and stagger its flow into the drainage network or watercourses; to prevent these reaching their capacity during heavy rainfall.

7.3 The entire car park area will use permeable paving providing 30% voids within the stone build-up of the paved area, allowing for temporary storage of surface water. The image below (taken from www.marshalls.co.uk) shows how voids within stone build up temporarily store water. Concrete baffles separate sections of the car park to further slow the rate by of flow between voided stone before it reaches the drainage network. Rainwater collected on the roof of the leisure centre will also be captured and filtered into the permeable paved area.
7.4 Release of water stored within the permeable paved area will be restricted to an agreed rate as recommended by the Site Specific Flood Risk Assessment.

**Pump House Site, E17**

7.5 Approved measures follow similar principles to Waltham Forest Leisure Centre as described above; i.e. the capture of water and delaying of its flow into the drainage network. However, due to lack of surface area available on site, below surface storage tanks will be used for the temporary storage of water rather than voids in the stone construction of the permeable paving.

**Walthamstow Stadium Site, E17**

7.6 A drainage scheme using permeable paving has been agreed through the planning process. A sub-base replacement system is being used to provide on-site water storage at high a level before discharging into the Ching. The design has provided a reduction in the rate of surface water discharge from the site.
7.7 As the development site is located within the flood plain the Environment Agency have insisted on compensation storage where site levels have been raised. Two ponds have therefore been integrated into the design to provide the required flood plain compensation.

Larkshall Road, E4

7.8 A SuDS attenuation / infiltration feature has been installed at Larkshall Road which receives runoff from the surrounding footways and part of the adjoining road. The surface water is collected by traditional road gullies and piped into a large gravel soakaway beneath the verges with a high level overflow that runs into the surface water sewer system.
Remedial works in response to historical flooding

7.9 In existing built up areas, remedial works may be carried out in response to reported flooding incidents. Typical issues and measures used in the borough are illustrated by the examples below.

Priory close E4

7.10 Provision of French drains to intercept ground water and prevent surface flooding, and provision of additional highway drain and additional gullies to improve interception of surface water run-off.

7.11 These works were carried out to prevent ground water from rising up through the existing road construction and laying on the finished road surface, which had been experienced by residents even during the summer months. The installation of these French drains also helped to intercept ground water reducing the level of ground water basement flooding experienced by residents in the close.
Woodside Gardens E4

7.12 Additional gullies provided to improve residential road drainage. These works were required to reduce surface water ponding caused by inadequate gully spacing and level problems within the channel line of the road.
Winchester Road E4

7.13 New parking bay gullies and road channel re-profiling works carried out to prevent surface water ponding within shopping parking bays.

7.14 The problem was reported to the Council by shoppers being inconvenienced by standing water when getting in and out of their cars when visiting the shops, also some reports of splashing of pedestrians when using the footway.
Rain Gardens

7.15 The introduction of rain gardens at suitable locations throughout the borough is being promoted in public realm enhancements and in new developments. Rain gardens are essentially shallow depressions in the ground with a highly permeable soil base. They are flexible in design and are suitable for gardens, communal spaces and along the roadside. This makes them ideal for both retrofit and new schemes.

7.16 With well selected planting rain gardens can provide colourful planting for all seasons, whilst adding to the green infrastructure of the local environment. Depending on location, rain gardens may require regular litter picking and inspections for pollution. Regular watering in the first year will aid in the establishment and survival of rain gardens. An annual weeding is essential in the two years until the ground cover has establish.
7.17 Planting of rain gardens is site specific and those plants that best suit a particular location are chosen from a generic list of agreed plants for the borough, consideration is given to height, colour flowering period and resistance to road salt as well as being able to survive in both wet and dry conditions.

NB source of images used on front cover = Susdrain 2012, and LBWF Level 2 SFRA (2011)
8 Appendix 1

8.1 From the 1 October 2008 permitted development rights that allow householders to pave their front gardens with hardstanding without planning permission have changed in order to reduce the impact of this type of development on flooding and on pollution of watercourses.

8.2 If the surface to be covered is more than five square metres planning permission will be needed for laying traditional, impermeable drive ways that do not provide for water to run to a permeable area.

8.3 Planning permission will not be required if a new or replacement drive of any size uses permeable (or porous) surfacing, such as gravel, permeable concrete block paving or porous asphalt, or if the rainwater is directed to a lawn or border to drain naturally.

8.4 Paved areas in front of houses can be provided without adding to flood risk and pollution by the use of permeable surfaces that allow water to drain into them or by other methods such as rain gardens.

8.5 There are three main types of solution to creating a permeable driveway:

- Using gravel or a mainly green, vegetated area.
- Directing water from an impermeable surface to a border rain garden or soakway.
- Using permeable block paving, porous asphalt or concrete.

8.6 Although planning regulations require permission to be granted for impermeable driveways for more than five square metres, enforcement has proved difficult and LBWF will never be able to completely stop residents from hard paving their front gardens using impermeable materials.

8.7 Before and after photographs of a typical domestic vehicle crossing with permeable blocked paved parking area within LBWF are shown below:
23 Hornbeam Grove, E4. – Construction of Domestic Vehicle Crossing / Permeable Parking Area.

8.8 Photograph of front garden prior to commencement of installation works:

8.9 Photograph of new permeable paving installed for use as parking area:
9 Appendix 2

Gully cleaning categories
10 Glossary

- **Critical drainage areas** - A discrete geographic area where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure.

- **Culvert** – a channel or pipe that carries water below the level of the ground.

- **Flood resilient** – this is a process whereby if flood water can enter the property, measures are taken to minimise the consequence of the flooding to the building and contents within the property and enable the property to be re-occupied as soon as possible after flooding occurs. Raised power sockets, boilers and utility meters and the use of flood resistant finishes such as treated wood or pvc can be used to achieve this.

- **Flood resistant** – measures to prevent flood water entering a building or damaging its fabric.

- **Floodplain** - the area that would naturally be affected by flooding if a river rises above its banks.

- **Fluvial flooding** – flooding that occurs in the floodplains of rivers when the capacity of the water courses are exceeded as a result of heavy rainfall, or snow and ice melting within catchment areas further upstream.

- **Groundwater flooding** – flooding from groundwater can happen when the level of water within the rock or soil that makes up the land surface (known as the water table) rises. The level of the water table changes with the seasons due to variations in long term rainfall and water abstraction. When the water table rises and reaches ground level, water starts to emerge on the surface and flooding can happen.

- **Hydrodynamic separator** – device that separates pollution such as sediment, litter and oil from surface water runoff.
**Register of flood management assets** - a register of structures or features which are considered to have a significant effect on flood risk within the borough. This includes features designed to provide a flood risk function, such as the Lee Valley Flood Relief Channel, but can also include structures not originally intended for such purposes; such as a fence or wall that incidentally prevents an area flooding. The register includes ownership and state of condition.

**Surface water flooding** – flooding from surface water happens when the drainage systems cannot cope with high levels of rainfall. It is extremely difficult to predict precisely where surface water flooding will happen as it is dependent on ground levels, rainfall, and the local drainage network.

**Sustainable Drainage Systems (SuDS)** – methods of management practices and control structures that are designed to drain surface water in a more sustainable manner than some conventional techniques. Examples include the use of permeable pavements, retention ponds, and swales (low tracts of land designed to manage water runoff).

**Trash screen** - A screen placed in a waterway to prevent the passage of trash which might otherwise restrict the flow and/or the capacity of a river, channel, stream or culvert.

**Tributaries** – a stream or brook that flows into a river.

**Water abstraction** – groundwater abstraction is the process of taking water from any source temporarily or permanently. Most water is used for irrigation or treatment to produce drinking water.

**Baffle** – a dam-like device used to restrict the flow of water from one area to another

**French Drain** – trench into which a perforated pipe is installed at the bottom of the trench and has been backfilled with shingle or similar coarse stone

**Sub-base** – stone construction layer beneath road surface