

# Flood Risk Management - Consenting of Works to Ordinary Watercourses

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This document sets out considerations when proposing works within or likely to affect the flow of an ordinary watercourse. This includes modifications to existing culverted ordinary watercourses.

## Preface

In April 2012 powers relating to ordinary watercourses were transferred from the Environment Agency (EA) to Lead Local Flood Authorities (LLFAs). This transfer of powers means that London Haringey LLFA is now the regulatory body for construction in, and maintenance of flow in all ordinary watercourses within the Borough.

Haringey LLFA is required by the National Flood Risk Management Strategy to adopt a proportionate and risk based approach to the management of local flood risk. This guidance document sets out how Haringey will fulfil its regulatory requirements to ensure that there is no increase in flood risk from works which relate to ordinary watercourses. This document sets out the requirements that will be applied locally by the LLFA when undertaking a technical assessment of proposed new culverting of watercourses, changes to existing culverted watercourses (or any other works) which may impact on flow within an ordinary watercourse.

This guidance has been adapted from EA's Culvert Policy and is supported by other specific considerations should be applied whenever a developer is considering undertaking works relating to an ordinary watercourse.

This document is intended for use by Haringey LLFA, landowners, developers and consultants acting on developers behalf. This is not a definitive design guide but provides pointers on what should be considered for design as well as setting out local preferences for ensuring on-going flood resilience within the Borough.

The objectives of this Guide are to:

- Provide a high level introduction to the extent and nature of Ordinary Watercourses within Haringey.
- Outlines the roles and responsibilities of Haringey LLFA and the Riparian Owner.
- Provide guidance to the developer on planning related issues regarding ordinary watercourse and outlines activities which may (or may not) be acceptable to Haringey Planning Authority.
- Clarify where consent may be required from the LLFA for works carried out in relation to an ordinary watercourse
- Provide initial design guidance and highlights areas which may require further consideration.
- Set out requirements for design, maintenance, access and inspection.
- Provide guidance on the requirement for hydraulic modelling.

This document is non-exhaustive and LLFA reserve the right to request additional information / measures as may be deemed necessary and required on a case-by-case basis.

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Data and figures presented within this guide are intended to guide and facilitate design (therefore easing the planning application and technical assessment process) and are to be used at the designers own risk. Haringey accept no responsibility or liability for the failure of any design.

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### ***Glossary of general flood risk terms used within this document***

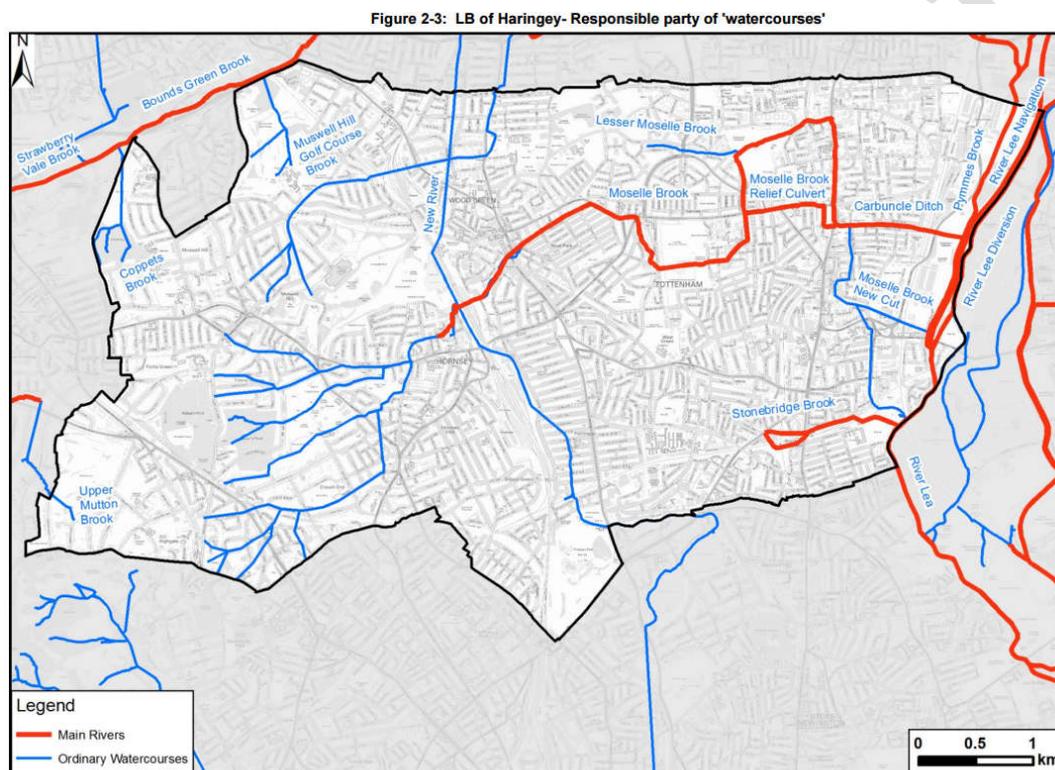
The following glossary provides definitions of some of the technical terms used within this document.

Bridge	An open span structure that carries a road, footpath, railway etc over a watercourse.
Culvert	A covered channel or pipeline used to continue a watercourse or drainage path under an artificial obstruction.
Cutwater	The wedge-shaped streamlined head of a bridge pier or other structure within a watercourse channel.
Invert	The lowest internal surface or the floor of a culvert.
Main river	All watercourses shown as such on the statutory main river maps held by the Agency. Main river can include any structure or appliance for controlling or regulating the flow of water in or out of the channel.
Ordinary watercourse	A watercourse which does not form part of a main river.
Watercourse	Includes all rivers, streams, ditches, drains, cuts, dykes, sluices, sewers (other than public sewers) and passages through which water flows.

## 1. Ordinary Watercourses within Haringey

Ordinary watercourses serve a vital function within Haringey in providing collection and conveyance of surface water to the main rivers. There is approximately 45km of ordinary watercourse within the Borough, with only a few short lengths remaining open channel. The requirements for consenting works in relation to ordinary watercourses apply equally to modifications to existing culverted ordinary watercourses.

Ordinary watercourses are deemed to be all rivers, ditches, drains, culverts, sluices, storm sewers (other than public sewers vested with Thames Water Limited or under private ownership including Canal and Rivers Trust ownership), which serve the purposes of conveying water but are not classified as Main River by the Environment Agency. The following figure illustrates the general locations of ordinary watercourses within the Borough.



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Haringey have responsibility for sections of the following ordinary watercourses;

- Lesser Moselle
- Upper Mutton Brook
- Coppets Brook (or Coldfall Wood Brook)
- Muswell Hill Golf Course Brook
- Muswell Stream
- Upper Moselle Brook Tributaries\*
- Lower Moselle Brook\*
- Lower Moselle Brook New cut\*

\* These Ordinary Watercourses are considered to be lost rivers. Their exact location and connectivity are uncertain due to lack of or conflicting information.

## 2. Roles and responsibilities

Within Haringey, Environment Agency (EA) have responsibility for Main Rivers, whereas responsibility for ordinary watercourses is shared between Haringey and riparian owners. Thames Water have responsibility for storm and foul sewers which they have adopted.

### Environment Agency

The EA remains the regulating body for the Water Framework Directive, Pollution, Impoundment, Abstraction and Discharges into the river network. Haringey has the same duty of care for the environment in its role of ordinary watercourse regulation.

### Haringey

Haringey LLFA is the regulatory body for ordinary watercourses and has the responsibility to ensure that any action undertaken on an ordinary watercourse (in connection with its responsibilities) do not compromise the water bodies' capability to meet its objectives under the terms of the Flood and Water Management Act 2010, Land Drainage Act 1991, Water Resources Act 1991 and the Water Framework Directive. The EC Water Framework Directive was transposed into national law in the England through The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003.

Whilst Haringey have a consenting and enforcement responsibility for ordinary watercourses, they are only responsible for the maintenance and management of ordinary watercourses which are vested by the Borough. There are numerous sections of ordinary (open channel and culverted) watercourse within Haringey where maintenance and management is the riparian owners responsibility.

### Riparian Owner

The riparian owner has the same level of management and maintenance responsibilities as Haringey LLFA for any ordinary watercourses not vested by Haringey. Where a watercourse forms a land boundary it is assumed that the riparian ownership (and therefore the responsibilities) of the watercourse is shared equally with the owners of the adjoining land on the opposite watercourse bank, which would also be taken as centre line of a culverted watercourse.

Riparian Ownership is assumed unless property deeds or land registry indicate other arrangements. Riparian owners have a responsibility to keep their watercourse clear of obstruction, which may require a degree of ongoing maintenance.

Riparian owners are required to:

- maintain the beds and banks of naturalised watercourse in its natural state on sections of open channel watercourse.
- keep the channel / culvert clear and free of all debris.
- maintain any structures owned by the riparian owner (or situated within curtilage of their land) such as culverts, trash screens, weirs, etc.
- ensure that any formal or informal flood defences such as walls and embankments are not breached by any works undertaken within the land holding.
- Maintain reasonable access to allow for ongoing future maintenance.

Haringey accepts that there may be instances that the Riparian Owner is unable to access the section of culverted watercourse situated on their land to undertake inspection and maintenance duties due to there being no point of access within the landownership boundary. Haringey will review such cases with the respective Riparian Owner to establish a pragmatic approach to inspection and long term maintenance.

Riparian ownership does not bestow any automatic rights upon the landowner to undertake additional culverting or any other engineering works relating to the watercourse. Works within the watercourse which would not be described as maintenance works will require the consent of LLFA and may also require planning permission through the local planning authority (LPA).

With a number of 'lost' watercourses across the Borough, many Riparian Owners may not be aware of the responsibilities as the existence of a culverted watercourse within their land holding may not be evident.



Example of Culvert under proposed redevelopment site

### 3. Planning Requirements

***The planning authority will not permit development that would impede the operational effectiveness of flood defence and drainage infrastructure or hinder access to enable maintenance of ordinary watercourses.***

***Culverting and / or canalisation of watercourses, whether undertaken as an operation in its own right, or as works associated with the development of land usually requires planning permission.***

***The requirement for ordinary watercourse consent is independent of the need for planning permission and the granting of planning permission does not imply or guarantee that Land Drainage consent will be granted.***

LPA will make a presumption for conservation of open watercourses in preference to culverting (DM24). The LPA will encourage and promote the removal of culverts (day-lighting) in order to restore a more natural river environment (DM24). Consenting of culverting will not be considered until other options have been thoroughly investigated. Potential alternatives to culverting are identified as follows:

- Provision of clear open span bridges with existing banks and bed retained;
- Revision of site layout to retain the existing open watercourse;
- Diversion of the watercourse in an environmentally sympathetic manner.

The LPA will only permit the modification of a watercourse, (culverting or canalisation) in the following circumstances:

- Where the culverting of short length of a watercourse is necessary to provide access to a development site or part thereof;
- Where it can be demonstrated that a specific length of watercourse needs to be culverted for engineering reasons and that there are no reasonable alternative courses of action.

If part of a watercourse is already culverted prior to proposing development, this does not infer that it will be permissible to extend. Each application will be assessed on its own merits. The erection of buildings or other structures (excluding pavements) over the line of a culverted watercourse is not permitted unless under exceptional circumstances. This is to facilitate replacement, maintenance or other future necessary operations.

DM 28 (Watercourses and Flood Defences) promotes the naturalisation of watercourses, in accordance with the Thames River Basin Management Plan and the London River Restoration Action Plan. The policy also provides direction on culverts, stating that there is general presumption against development where culverting would adversely affect the functioning of main rivers and ordinary watercourses. Furthermore, development on sites already containing culverted watercourses, are expected to investigate measures to restore sections of the watercourse.

Building Regulations (Approved Document H) stipulate the distance from which a watercourse or sewer should be constructed from new foundations.

Following the guidance of NPPF / PPS25 developers will be required to maintain an overland flow route in the event that the culvert should become blocked or its hydraulic capacity exceeded. The flow routing analysis should be demonstrated as part of planning application submission. .

## 4. LLFA Consenting Requirements

*Haringey LLFA adopt a precautionary approach to culverting of watercourses. They will seek to ensure that the potential adverse risks to flood risk, flood defence and the environment are minimised.*

*Where culverting is required (for essential access for example) the applicant will be required to demonstrate how concerns relating to flood risk at the proposed culvert and any increase in risk elsewhere are addressed as increased flood risk will not be acceptable.*

The following sections of the Land Drainage Act 1991 apply to the LLFA carrying out their regulatory duties;

- *Section 21 – Enforcement of obligations to repair watercourses, bridges, or any other structures within channel or having potential to affect flow within an ordinary watercourse*
- *Section 23 – Prohibition on obstructions in watercourses. This includes culverting and connection of storm water (discharge headwalls).*
- *Section 24 – Contraventions of prohibition on watercourses*
- *Section 25 – Powers to require works for maintaining flow of watercourse.*

Any culverting of existing watercourses requires the consent of the LLFA under Section 23 (Land Drainage Act 1991). Similarly, any lengthening or amendment of an existing culvert, installation of trash screens, construction of headwalls etc. will also require consent. In essence, anything that would constitute a restriction within the watercourse may require consent under Section 23.

Applicants should seek advice from LLFA in regard to fees and billing procedures for the consenting process.

### 4.1. Type of Works Requiring Consent

Whilst there are a small number of lengths of ordinary watercourses within Haringey, the majority are culverted. It is noted that consenting applies for both temporary and permanent works.

As the majority of ordinary watercourses in Haringey are culverted, the flowing examples have been adapted to a culverted scenario.

The following activities require consent under *LDA 91 Section 23 (1)(c): No person shall alter a culvert in a manner that would be likely to affect the flow of an ordinary watercourse, without the consent in writing of the drainage board concerned.*

- Replacement of single culvert opening with two (or more) smaller culverts. Whilst capacity may be maintained there is an increased risk of blockage.
- Diversion of existing culvert alignment route. Incorporation of bends and increase in culvert length has potential to reduce the conveyance capacity of the culvert and increase risk of blockage.
- Culvert rehabilitation (concrete lining or similar) which reduces the internal cross sectional area of the culvert.

- Installation of non-return valve or gate which projects into cross-section of the culvert when open
- Installation of service ducts (or any other impediment) through the culvert opening
- Installation of one, (or a number of,) service ducts which are affixed to the internal wall of the culvert
- Installation of a safety chain (which has potential to cause blockage and reduce capacity of culvert)
- Installation of access ladders which has potential to obstruct the main cross-section of the culvert
- Daylighting of culvert
- Directing flow connections into the main flow of the ordinary watercourse. Connections should be aligned such that significant headlosses are not generated from incoming flows.
- All works carried out within 8m of external face of ordinary watercourse culvert. Haringey LLFA should be consulted whenever works are within 16m of an ordinary watercourse culvert.

The following activities will **not be consented** unless under exception circumstances.

- Building over culverts.
- Installation of siphons as a modification to the vertical alignment of a culvert.

Works in relation to normal open ordinary watercourse channels may still require consent. Further details for open watercourse consenting requirements are provided in **Appendix B**.

Consent application forms are provided in **Appendix C**.

#### **4.2. Flood Defences, Main Rivers and WFD Assessments**

Where a new development proposal is located beside a flood defence, control structure or watercourse it is essential that an adjacent working strip is retained to facilitate future maintenance by LLFA, other statutory undertaker or the riparian landowners. The working strip should have a minimum width of 8 metres, but larger distances may be required dependent upon maintenance requirements and site layout for clear access and egress at all times. Similar measures apply when developing adjacent to a watercourse, regardless of whether it is open channel or culverted.

Where development is proposed within 16 metres of an ordinary watercourse it is advisable to contact Haringey LLFA.

The artificial modification of watercourses is likely to have impacts which are contrary to the objectives of sustainable development as embodied in The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2015 and the Flood Risk Regulations 2009. Where there is potential for works to impact on the environment or removal (or reduction) of the extent of habitat, LLFA will require a Water Framework Directive Assessment to be satisfactorily completed (demonstrating that the development does not impact on ecological status of the watercourse) prior to works being consented.

### 4.3. Connection of storm systems to an ordinary watercourse

The rate of run-off from developments from a proposed site shall be agreed with LPA or Thames Water dependent upon the ownership of the receiving waterbody/structure.

For future maintenance purposes a preference is stated for storm water connections to ordinary watercourses along open sections of watercourses in preference to connections made within culverted sections.

The following should be referred to for acceptable headwall details.

<http://www.standardsforhighways.co.uk/dmr/vol4/section2/ha10704.pdf>

A non-return valve / flap-gate valve should be installed where anticipated high water levels within the receiving ordinary watercourse could cause an increased risk of flooding to the connecting storm system. Any installed device should be easily accessible and visible to allow for future maintenance and a maintenance plan developed with responsible parties identified for the upkeep of devices.

### 4.4. Trash and Security Screen

The installation of a security or trash screen on an existing culvert, or a proposed culvert should be justified by the developer and evidence for the installation, or non-installation should be submitted to Haringey for review.

The main risk with fitting trash screens is the risk of blockages and subsequent flooding risk, whereas the benefits include reducing the risk of blockages within culverts and prevention of intentional or accidental access to a culvert. A risk based approach should be adopted during the design process with the expectation that screens are fitted to culverts (that currently do not have screens) if the benefits can justify the risk.



Example of screen and siltation causing partial blockage of culvert. (image courtesy Halcrow)

It is recommended that the developer refers to EA /DEFRA guidance 'Trash and Security Screen Guide 2009'.<sup>1</sup>

As a general guide security screens are not recommended on the outlets of culverts due to the risk of persons entering the culvert become trapped; only where the risk of persons entering a culvert from the downstream end of a culvert are sufficiently high should security screens be considered.

The screen layout and design must make provision for an adequate and safe means of cleansing and maintenance. A formal maintenance regime must be submitted with the application and agreed prior to consent. Parties with private maintenance liabilities shall be clearly stated and contact details provided.

#### **4.5. Maintenance**

The responsibility for on-going culvert maintenance and rehabilitation of an ordinary watercourse must be agreed in writing with the LLFA and details of those responsible for maintenance submitted with application for consent. The responsibility for the maintenance of a culvert lies with the riparian owner (unless otherwise specified).

#### **4.6. Undertaking of non-consented activities**

Under Section 24, if works are executed without first obtaining formal written consent, the LLFA, have the power to serve legal notice requiring that the restriction is removed within an appropriate timescale. Failure to observed the notice to undertake remedial works is an offence under the LDA 1991, and can result in the Borough carrying out the necessary remedial works and seeking to recover costs.

#### **4.7. Other Permissions**

Other permissions may be required, for example for designated sites, conservation areas etc. It is the responsibility of the applicant to familiarise themselves of all necessary consent requirements.

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<sup>1</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/291172/scho1109brhf-e-e.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291172/scho1109brhf-e-e.pdf)

## 5. General design requirements for culverting

Haringey state a presumption against culverting of existing 'open' watercourses. Where culverting is consented in principal (by LPA and LLFA) the following design advice is provided to ensure that detailed design meets a suitable standard with detailed designs to be submitted for formal consenting process.

This advice equally applies to amendments to existing culverts - such as diversion of a watercourse to facilitate development for example.

All culverting proposal submitted to LLFA for consideration should be designed in accordance with the following documents;

- EA /DEFRA - Trash and Security Screen Guide 2009CIRIA
- CIRIA C689 – Culvert Design and Operation Guide 2010
- CIRIA C720 - Culvert Design and Operation Guide supplementary technical note on understanding blockage risks.

### 5.1. General requirements

- Detailed hydraulic and structural design will be required to be undertaken by a suitably qualified engineer.
- The length of culvert should be minimised to specific requirements (generally less than 10m for access crossing points).
- Designs should cater for exceedance flows. Consideration must also be given to overland flow paths in the event of a culvert becoming obstructed.
- A single large culvert is preferred to multiple small culverts.
- Allowance should be made for appropriate levels of freeboard and climate change provision; flow estimation is not an exact science.
- Locating service ducts within culverts should be avoided and will not be permitted.
- Careful consideration should be given to the provisioning of trash and security screens as stated in Section 4.2.
- Design of culverts should cater for future access, inspection and maintenance.
- Storm water connections within culverts should be avoided due to issues regarding future maintenance.
- Design must consider potential for scour and undermining of structures.

### 5.2. Detailed design

- The shape and dimensions of the culvert and the materials used for construction should be chosen to satisfy site-specific requirements in terms of channel hydraulics, strength and durability, and should be appropriate to the local environment.
- The use of different cross-sectional details within a culvert length should be avoided.
- Appropriate inlet and outlet structures should be designed to ensure smooth hydraulic transition and avoid erosion. The type and appearance of inlet and outlet structures should be sympathetic to its environs.
- Suitable access arrangements for maintenance should be included in the design. Access chambers must be provided at each change of direction if the culverting is not on a straight alignment. Sharp bends (exceeding 45 degrees) should be avoided with a preference for long radius bends if required. The maximum spacing between access chambers should not exceed 100 metres.

### 5.3. Environmental Considerations

- Designs should cater for potential establishment of a natural river bed.
- The applicant should consider the environmental implications of all options for the works to determine the least environmentally damaging solution. If no other alternative is feasible, any proposed culvert length should be as short as possible and the diameter determined based on both hydraulics and hydrology of the existing watercourse i.e. a small diameter culvert may increase average flow velocities and change the ecological habitat of the natural watercourse bed. Depending on local circumstances we shall require a minimum culvert diameter of 600mm.

### 5.4. Environmental Mitigation

- Position the invert of the culvert below the natural bed of the watercourse, to enable natural bed features to form. As a guide the embedment depth should be  $D/4$ , where  $D$  is the diameter for circular culverts or height for non-circular openings, for diameters up to 1.05m diameters,  $D/6$  for pipes larger than 1.05m up to 1.8m inclusive or otherwise a minimum of 0.3m. Allowance for an embedment depth that will be assumed to be silted should be allowed for in hydraulic calculations.
- Where appropriate suitable provision should be made for anticipated mammal passage either within or close to the culvert.
- The height of the invert and low flow depths within culvert should not pose an obstruction to fish movement. There should be no step between culvert outlet and natural watercourse bed; refer to embedment depth details.
- Propose suitable environmental enhancements, for example opening up a length of previously culverted watercourse elsewhere on the site, enhancing other lengths of the watercourse, creation of a water related habitat areas which improve potential for biodiversity and have connectivity with the watercourse.
- Construct headwalls and wingwalls in 'soft-engineering' or natural materials in keeping with the natural channel where suitable.

### 5.5. Freeboard

Design freeboard is defined as the height of the culvert soffit over the defined / modelled flood water level. A freeboard depth will provide additional capacity and increases the potential for the passage of floating debris through the culvert.

For ordinary watercourses within relatively small channels a freeboard of 300mm is considered adequate. For free-flow conditions, i.e. when neither the inlet nor the outlet of the culvert is submerged at peak design flow, a rough guide is that the freeboard should be  $D/4$  where  $D$  is the diameter for circular culverts or height, for non-circular openings.

### 5.6. Climate Change

The application of Climate change will be on a site by site basis and based on the following factors;

- Vulnerability classification of the site
- Design life of the scheme

- 
- Flood zone in which the development is located (which may be associated with the works proposed to the watercourse)

Flow increases for climate change may range between 10% and 70% increase on derived 1 in 100 year flood flows.

Where the development solely consists of the works within channel a 25% climate change allowance should be made for long term installations.

Further information is contained within **Appendix D**.

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## 6. Hydraulic modelling requirements

Any proposed obstruction within, or realignment of the ordinary watercourse that may increase flood risk from the ordinary watercourse will require hydraulic modelling to demonstrate that the risk of flooding is not increased.

Haringey LLFA state no preference for the software package used in hydraulic modelling undertaken to inform Section 23 consent application. EA hydraulic modelling benchmarking reports should be referred to for guidance on acceptable hydraulic modelling software packages.

Hydraulic modelling will be required in any part of the Borough, not just in those areas which are defined as Critical Drainage Areas (CDAs).

It is generally assumed that proposals which are in close proximity to an Ordinary Watercourse or involve in channel works will be accompanied by Flood Risk Assessment, however, this may not always be the case.

Modelling may therefore still be required for works that do not require consent under Section 23. Hydraulic models where required for submission should be accompanied with a model audit report and model user guide.

The following is to be considered when establishing information requirements for undertaking hydraulic modelling:

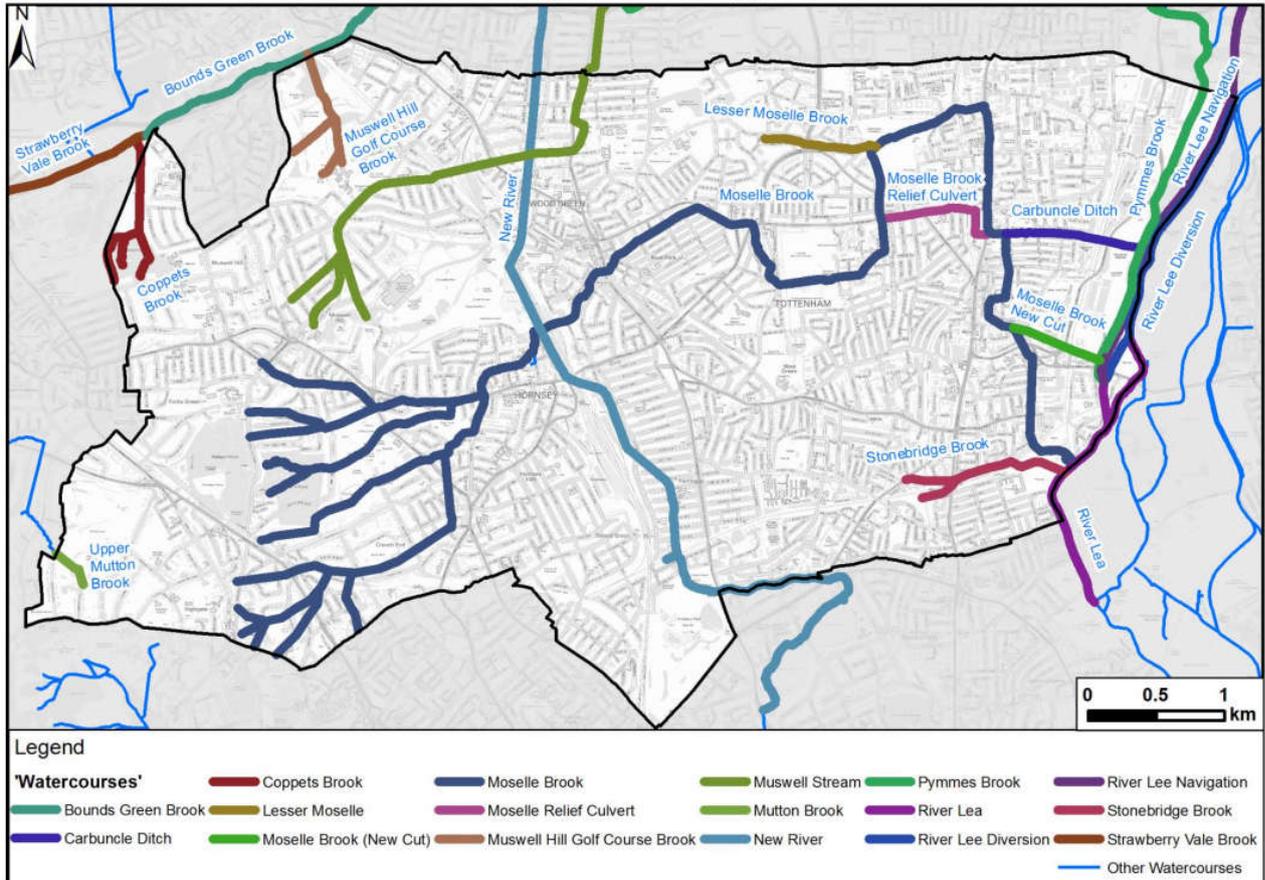
- The infrastructure should be represented as current conditions. i.e. if the existing channel is shown to be partially silted this condition should be reflected in the model. The system cannot be assumed to be fully cleansed solely for the purpose of the analysis even if recent maintenance works have been undertaken.
- For culverting proposals a 50%, 75% and 100% blockage analysis should be undertaken (at the opening of the culvert).
- The modelling should demonstrate that the culvert is suitably sized for climate change and freeboard (C689) (see previous section of this guide)
- Where flows come out-of-bank and have the ability to flow in multiple directions there is likely to be a requirement for 2D flow analysis to understand the risk to the surrounding areas.
- Expansion and contraction values at culvert openings for the model should be carefully considered. Default software values may not be representative.
- When modelling the river reach it will be necessary to model sufficiently downstream to ensure that there is an accurate representation of modelled water levels at the culvert location.
- Design of culverts should demonstrate free flowing conditions at the outlet for the design horizon; culverts should be designed as inlet controlled. If the tail water level rises above culvert soffit, the system will operate under surcharged conditions.

For avoidance of doubt, any works that have the ability to impact on the conveyance of design flow within channel, directly above channel, or out of channel within the associated floodplain, should be assessed via hydraulic modelling.

## Appendix A – Ordinary Watercourses Location Plans

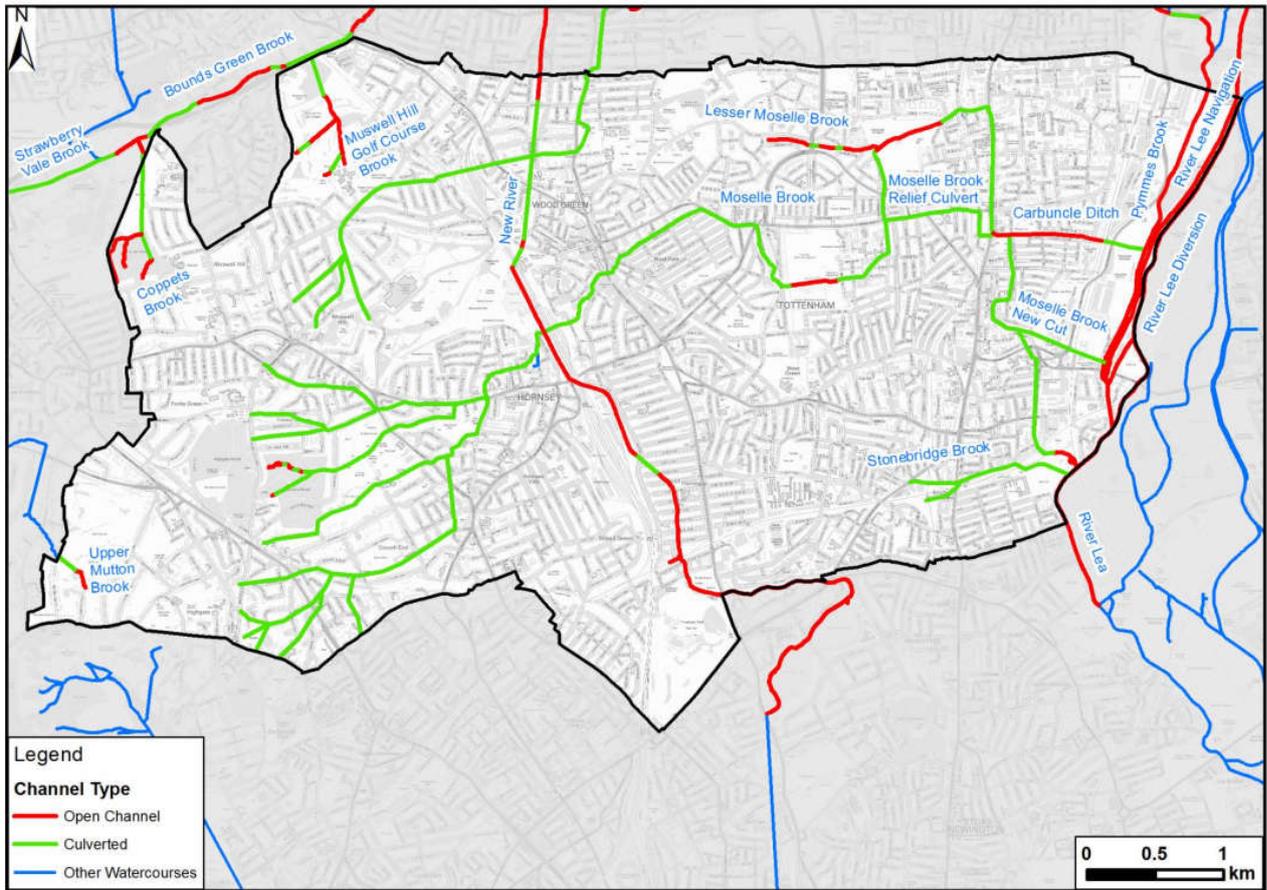
It should be noted that the following plans shows the known watercourses within the Borough; additional ordinary watercourses (ditch lines, channels etc) also exist. No guarantees are offered on the accuracy of the alignments shown.

Figure 2-1: LB of Haringey- 'watercourses'



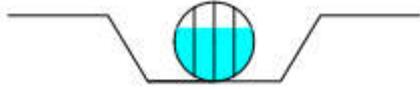
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Figure 2-2: LB of Haringey- Channel Type



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## Appendix B – Ordinary Watercourse consentable activities



**Trash Screens** - Consent required as it is an alteration to a culvert and has the potential to obstruct flow under section 23 (1)(c).



**Bank Protection Works** - Not Consentable under LDA 91, (Temporary works may require consent).



**Pipe Crossing (in channel)** - Consent Required under Section 23 (1)(a) if placed on bed and under Section 23 (1)(b) if above bed.



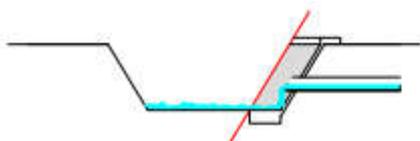
**Pipe Crossing (above bank)** - Not Consentable under LDA 91 as it does not affect the watercourse.



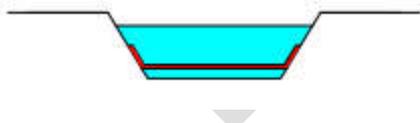
**Pipe Crossing (below bed)** - Not Consentable under LDA 91 as it does not affect the watercourse - Potential temporary works consent.



**Protruding Pipe Outfall** - Not Consentable under LDA 91 as it will not act like a dam/weir or like obstruction.



**Outfall within Bank profile** - Not Consentable under LDA 91 as it does not act like a mill dam or weir.



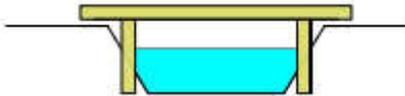
**Weir/Dam or impoundment or temporary works that obstruct flow** - Consent Required under Section 23 (1)(a).



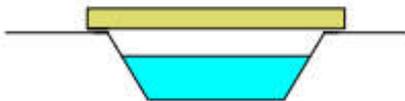
**Bridge (where soffit level is below bank top level) -**  
Consent Required under Section 23 (1)(b) as it acts like a culvert.



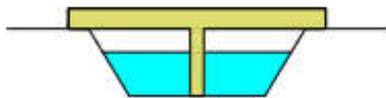
**Bridge (abutments not reducing flow area/width) -**  
Not Consentable under LDA 91 as does not interfere with flow.



**Bridge (abutments restricting flow) -** Consent  
Required under Section 23 (1)(b) as it acts like a culvert.



**Clear span bridge -** Not Consentable as it does not affect the watercourse.



**Bridge with support in channel -** Not Consentable under LDA 91 as it will not act like a dam/weir or like obstruction. Need to consider size of pier against size of watercourse, but would want to discourage the use of a pier in the watercourse.

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**Appendix C – Section 23 Consent forms**

Living draft

## Appendix D - Climate change

Guidance published by DEFRA in February 2016 which provides regional projections on river flow increases. Application of climate change should be discussed with LLFA in the sizing of new culverts.

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	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%

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

Consider the [flood zone](#) and the appropriate [flood risk vulnerability classification](#) to decide which allowances applies to your development or plan. This will help you understand the range of impact. The higher central, central, and upper end allowances are in [table 1](#).

#### *In flood zone 2*

- essential infrastructure – use the higher central and upper end to assess a range of allowances
- highly vulnerable – use the higher central and upper end to assess a range of allowances
- more vulnerable – use the central and higher central to assess a range of allowances
- less vulnerable – use the central allowance
- water compatible – use none of the allowances

#### *In flood zone 3a*

- essential infrastructure – use the upper end allowance
- highly vulnerable – development should not be permitted
- more vulnerable – use the higher central and upper end to assess a range of allowances
- less vulnerable – use the central and higher central to assess a range of allowances
- water compatible – use the central allowance

#### *In flood zone 3b*

- essential infrastructure – use the upper end 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

If (exceptionally) development is considered appropriate when not in accordance with flood zone vulnerability categories, then it would be appropriate to use the upper end allowance.