Flood Risk topic paper

This topic addresses: Flood risk and new development.

SA Objective:

2. To build **resilience to climate change**, including reducing risks from overheating, flooding and the resulting detriment to well-being, the economy and the environment.

SEA Theme: Water, climatic factors and human health.

Introduction

The city of Oxford is located location at the confluence of two rivers, the Thames and the Cherwell, as well as numerous watercourses, and the risk from river flooding is one source of flooding that has the potential to impact development in Oxford. Other sources of flooding in Oxford include groundwater, surface water and sewer flooding. The ongoing impact of climate change, including projected wetter winters and increased incidences of intense rainfall events, is likely to exacerbate these risks in the future, with a variety of negative consequences for property, economy and ecosystems as well as human health.

Oxford has a history of flood events with the most recent being at the start of 2021 where a number of flood warnings were issued, temporary defences deployed, several roads closed and footpaths along the city's waterways completely obscured. Other recent flood events were in January 2014, November 2012 and July 2007, each of which resulted in significant disruption to the city. This recent series of flood events resulted in a programme of short-, medium- and long-term measures including the development of a flood alleviation scheme for Oxford, or OFAS. The primary purpose of which is to reduce the risk of flooding for properties and infrastructure.

This topic paper provides a brief overview of some of the flooding issues in Oxford. It begins by taking a look at flooding from a policy perspective reviewing relevant policies, plans and programmes at the national, regional and local level. It then goes on to set out the current situation for flooding in Oxford, looking at each source of flooding in turn and how they present a different set of issues. Then the paper moves on to look at what would happen if we didn't produce a plan before setting out what potential topics could be included in the new plan. Finally it draws out some of key issues relating to flooding.

Plans Policies and Programmes

The Flood and Water Management Act, 2010

This piece of legislation requires better management of flood risk, creates safeguards against rises in surface water drainage discharges and protects water supplies for consumers. It gave a new responsibility to the Environment Agency for developing a National Flood and Coastal Risk Management Strategy, and established upper tier local authorities (in our case Oxfordshire County Council) as Lead Local Flood Authorities and provided them with a range of duties.

National Planning Policy Framework

Paragraphs 155-165[1] set out the national planning policy for planning for development in flood risk areas. It requires a sequential approach to development: sites 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. It also requires an exception test for proposed development in areas of flood risk: this requires proposed development to show that it will provide wider sustainability benefits to the community that outweigh flood risk, and that it will be safe for its lifetime, without increasing flood risk elsewhere and where possible reduce flood risk overall.

Paragraphs 162-164 focus primarily on planning applications and Paragraph 165 provides that sustainable drainage systems should be incorporated into major planning applications unless there is clear evidence this would be inappropriate. Local Planning Authorities need to have appropriate policies in place on sustainable drainage systems. The NPPF (paragraph 118) recognises that some undeveloped land can perform many functions, including flood risk mitigation.

The NPPF also requires that Local Plans should be supported by a Strategic Flood Risk Assessment (SFRA) and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies. The NPPF states that the SFRA will be the basis for determining the sequential approach to development. This is important as applicants need not apply the sequential test again on sites allocated in the development plan through the sequential test.

A draft version of the NPPF was consulted on between January and March 2021. A few minor amendments are proposed to the flooding policy but mainly it brings more clarity and highlights that all sources of flood risk should be considered when applying a sequential, risk-based approach to the location of development. A Flood Risk Vulnerability Classification is also proposed in the appendix.

National Planning Practice Guidance (PPG)

The PPG reinforces the NPPF's use of the sequential test and exception test. Paragraph 065 of the PPG refers to a table[2] which sets out the definition of the different flood zones:

- Flood Zone 1 has the **lowest** probability of flooding.
- Flood Zone 2 has a **medium** probability of flooding
- Flood Zone 3 has a **high** probability of flooding
- Flood Zone 3b is the **functional flood plain and** this zone comprises land where water has to flow or be stored in times of flood.

The PPG on Flood Risk and Coastal Change provides more detailed guidance as to the application of the sequential and exception tests in the context of plan-making and planning applications. It also, provides additional information on the "sequential, risk-based approach to the location of the development" or the "sequential approach" and provides some over-arching guidance relating to "taking flood risk into account in the preparation of Local Plans".

[1] https://www.gov.uk/government/publications/national-planning-policy-framework--2
[2] https://www.gov.uk/guidance/flood-risk-and-coastal-change#Table-1-Flood-Zones

National Design Guide (2019)

The National Design Guidance acknowledges that "in well-designed places, water features form part of an integrated system of landscape biodiversity and drainage". It highlights the importance of sustainable drainage systems and the importance of designing development to "adapt to flood conditions". The focus of the National Design Guide seems to be on adaptation to the increased risk of flooding (paragraphs 135, 147) and using natural resilience (paragraph 149).

Planning White Paper – Planning for the Future, 2020

The recent planning white paper refers to a greater standardisation of technical supporting information, for instance about flood risk.

National Flood and Coastal Erosion Risk Management Strategy for England Action Plan, 2021

This recently-published (May 2021) Action Plan helps to deliver the Strategic Objectives set out in the Environment Agency's Flood and Coastal Erosion Risk Management (FCERM) Strategy published in 2020. Actions include the Environment Agency working with the National Flood Forum to expand the network of community flood groups, to support residents and local businesses develop flood response plans and train wardens and to develop on-line training materials for town planners on flood risk and climate change. Specific mention is made to Oxford with regard to maximising opportunities for flood resilience as part of contributing to environmental net gain in development proposals. This is discussed in the context of the production by the Environment Agency and partners of a Natural Capital Plan for the Oxford-Cambridge (OxCam Arc) growth area.

Thames Catchment Flood Management Plan, Environment Agency, 2009

Oxford is one of the areas identified in this Thames Catchment Flood Management Plan[3] as containing a heavily populated floodplain. At the time of the plan's publication, 4,000 properties in Oxford had a 1% risk of flooding (from rivers). By 2100, it was predicted for this number to increase to 4,660 properties. The flood risk is concentrated in known locations. Large scale interventions will be expensive and difficult to build and maintain. Adaptation of the places at risk and of people's behaviour has the potential to manage risk. However, this will take time and will not always meet the expectations of the communities at risk.

Our Catchment Plan, Thames Water, 2018

Thames Water produced a plan[4] which includes an analysis of the causes of sewer flooding and pollution in the Oxford catchment. These include: heavier and more intense rainfall events

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[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/293903/Thames_Catchment_Flood_Management_Plan.pdf

[4] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-reports/2018-catchment-plans/oxford-catchment-plan.pdf

happening more often; deterioration within the sewerage network and blockages caused by fat, oil and grease deposits, resulting in flooding and operational issues; loss of local river flood plains; and increasing river flooding. The report notes that the foul sewers were not designed to cope with surface water. For example in the Grandpont area, the deterioration of some of the sewers within their network has allowed groundwater into the foul sewers. At Abingdon Road, flooding from surface water sewers has also occurred as a result of high river levels and / or restriction of the outfalls due to vegetation growth.

The Our Oxford catchment plan is currently at the Options Appraisal stage. Thames Water are recommending an intervention comprising of short, medium and long term measures. Short term activities will include their ongoing work to improve the operation of their network and their response to problems as they occur. Medium term activities will include the refurbishment of their local sewerage network to reduce pollution and foul sewer flooding. Long term activities include the review and refinement of their catchment approach based on the experience gained, and outcomes achieved from the short and medium term interventions.

Oxford City Council "Our Strategy" 2020-24

The City Council's "Our Strategy"[5] document sets out the importance of working with partners to deliver improved flood defences and managing the increased risks of flooding in order to help the city become more resilient to climate change.

Oxford Local Plan 2036 Policies on Flood Risk

The Oxford Local Plan 2036 contains a number of policies that relate to flood risk. In particular, Policies RE3 and RE4 set out the City Council's approach to flood risk, sustainable drainage, and also provide the policy approach in relation to water management at some of Oxford's important nature conservation sites. Policy RE3 includes strict provisions as to what development will be granted planning permission in Flood Zone 3b. Any proposal must meet all of the criteria in this policy and must be for water-compatible uses or essential infrastructure; or, where it is on previously developed land, it must represent an improvement of the existing situation in terms of flood risk.

Policy RE3 was informed by the Flood Risk and Sequential Test of Sites Background Paper[6]. In line with the associated guidance in the PPG, when developing site allocation policies, the sequential test was applied if any of the potential sites were outside of Flood Zone 1. Before allocating sites in higher risk flood zones, it was demonstrated that there were no reasonable alternative sites available in areas with a lower probability of flooding that would have been appropriate to the type of development or land use proposed. Any proposals for the development of sites in Flood Zone 3a that incorporated 'more vulnerable' uses such as housing also required the exception test. In the case of Oxford, where previously developed sites in Flood Zone 3b were proposed, an exception test was also required. Paragraphs 1.21 to 1.59 of our Statement of Common Ground with the

[5] https://www.oxford.gov.uk/downloads/file/7528/oxford_city_council_our_strategy_2020-24
[6] https://www.oxford.gov.uk/downloads/file/5558/bgp9_-_flood_risk_and_sequential_test_of_sites

Environment Agency[7] provide more detail as to how the sequential and exception tests are applied in Oxford.

The Flood Risk and Sequential Test of Sites Background Paper set out the individual capacities of sites within each Flood Zone and demonstrated that Oxford had insufficient capacity to accommodate its housing need within lower risk flood zones. Consequently development sites were allocated within higher risk flood zones applying the sequential test. These sites must be accompanied by a site-specific flood risk assessment when planning permission is sought.

Current situation

In Oxford there are major technical obstacles which mean any solutions to flooding will be expensive, provide different levels of protection and not benefit everyone in the affected communities. Proposals can be brought forward that will reduce the risk to many people, but major flood defences are not a realistic option in the foreseeable future. The most sustainable way of reducing flood risk in Oxford will be through a Flood Risk Management Strategy.

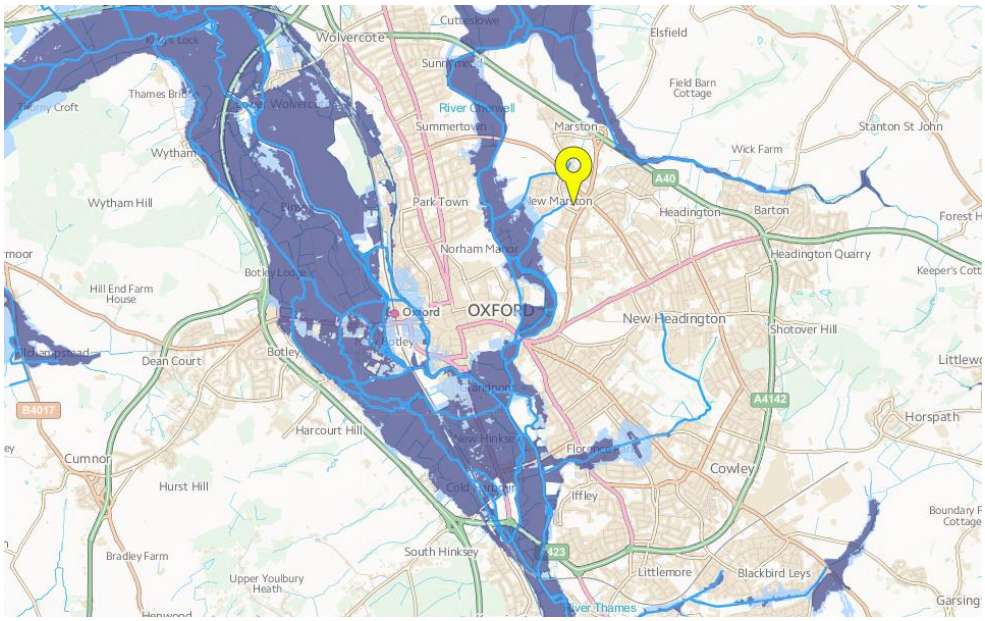
As set out in the introduction, flooding occurs from a number of sources including groundwater, surface water, river, and sewage flooding. Each will be looked at in turn to present a current picture of what is happening in the city.

River Flooding

River Flooding (or fluvial flooding) occurs when a river bursts its banks and water spills out onto the surrounding land. This type of flooding is caused by heavy rain. As can be seen from Figure 1, large parts of Oxford are at risk from this type of flooding. Some areas of flood risk in Oxford allow the river to naturally burst its banks onto river floodplain, however other areas have properties in them. According to the Thames Catchment Flood Management Plan, produced by the Environment Agency in 2009, Oxford has between 2,000 and 5,000 properties at risk from river flooding.

[7] https://www.oxford.gov.uk/downloads/file/5577/com4_-_statement_of_common_ground_-_environment_agency

Figure 1: Flood map showing risk of river flooding in Oxford (Environment Agency, 2021)[8]



Groundwater Flooding

According to the Environment Agency (EA)[9], groundwater flooding "can happen when the level of water within rock or soil underground – known as the water table – rises. When the water table rises and reaches ground level, water starts to seep through the surface and flooding can happen. This means that water may rise up through floors or underground rooms such as cellars or basements." Groundwater flooding can occur in river valleys in locations with sand and gravel as the underlying geology. Oxford's geology has some locations that fit this description and as such there is a risk of groundwater flooding in the city.

The Environment Agency and British Geological Survey have investigated the nature and mechanisms behind groundwater flooding in Oxford. In the majority of cases it has been found that local ground water is linked to river flows and has an independent response to rainfall. There is a lack of reliable data however, therefore a system of water level measurement points for future monitoring purposes has been established.

The Environment Agency holds and updates a groundwater flooding register identifying the locations and nature of specific groundwater flooding events. For Oxford, the groundwater register has identified 21 records of suspected ground water flooding. These occurred between 2000 and 2003 and 2007 and 2009. 15 of the incidents occurred within the city, whereas 6 were located just outside the city's boundary. Groundwater flooding tends to occur in low lying areas, with clusters of incidents in New Hinksey, Grandpont and New Botley. These three areas all lie within Flood Zone 3, so the groundwater incidents are likely to be associated with fluvial flooding[10].

[8] https://flood-map-for-planning.service.gov.uk/
[9] https://environmentagency.blog.gov.uk/2019/12/23/what-is-groundwater-flooding/
[10] https://www.oxford.gov.uk/downloads/file/6443/rse1_-_the_oxford_city_strategic_flood_risk_assessment_level_1_sfra

Four of the incidents reported immediately to the west of the Cherwell-Thames confluence are within Flood Zone 1. The sites are located on gravels like those within the floodplain. Although the incidents took place within Flood Zone 1, the proximity of the Rivers Cherwell and Thames means that groundwater emergence is likely, especially during periods of high water level in the two rivers[11].

Surface Water Flooding

Surface water flooding happens when rain from heavy storms overwhelms local drainage capacity. It is a significant risk affecting 3.2 million properties in England[12]. Surface water flooding is more difficult to forecast than flooding from rivers as it is often caused by periods of intense rainfall. This is because "current meteorological methods are not able to determine where this heavy rain will fall with the necessary levels of precision, and useful forecast lead time."[13]

There are several high risk areas near the city centre where surface water pools, including large parts of St Aldates and Speedwell Street to the south of the city, and George Street to the west. Ground levels to the west and south of the city in particular are lower than those in the city centre, which may explain why water is shown to pool in these locations.[14]

The greatest risk of surface water flooding is around Florence Park and the St Gregory the Great School grounds. This appears to be predominantly pluvial (rain) flooding from the wider catchment. The updated Flood Map for Surface Water also indicates extensive pluvial flooding to the south of Cowley. However, the culverted length of the Boundary Brook in this location will serve to convey some of this overland flow[15].

Sewer Flooding

Sewer flooding is when sewage or foul water leaks from the sewerage system (through pipes, drains or manholes) or floods up through toilets, sinks or showers inside a building[16]. Sewer flooding into an outside space, such as gardens, roads or public parks is known as "external flooding". If sewage enters a building, it is known as "internal flooding".

Certain areas of the city (e.g., New Marston) have experienced sewer flooding, particularly in external areas such as on the highway, often after extreme weather events. The Level 1 Strategic Flood Risk Assessment[17] (November 2017) indicated that the number of properties deemed to be at

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[11] *ibid*
[12] https://www.gov.uk/government/publications/surface-water-management-action-plan
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/725664/surface-water-management-action-plan-july-2018.pdf
[13] *ibid*
[14] https://www.oxford.gov.uk/downloads/file/6443/rse1_-_the_oxford_city_strategic_flood_risk_assessment_level_1_sfra
[15] *ibid*
[16] House of Commons Library Briefing Paper Number CBP7839 – Sewer Flooding
http://researchbriefings.files.parliament.uk/documents/CBP-7839/CBP-7839.pdf
[17] https://www.oxford.gov.uk/downloads/file/6443/rse1_-_the_oxford_city_strategic_flood_risk_assessment_level_1_sfra

risk of flooding from Marston Brook and Peasmore Brook (both of which run in close proximity to New Marston) was 302 and 687 dwellings respectively.

Strategic Flood Risk Assessment (SFRA)

The NPPF requires that Local Plans should be supported by an SFRA and develop policies to manage flood risk from all sources, taking account of advice from the Environment Agency and other relevant flood risk management bodies, such as Lead Local Flood Authorities. The most recent SFRA was undertaken to support the current adopted Oxford Local Plan 2036 and it provides information to enable the City Council to prepare appropriate policies for the management of flood risk in planning documents. It also identifies the level of detail required for site-specific FRAs in particular locations. An excerpt of the mapping from the SFRA is illustrated in Figure 2.

Figure 2: SFRA Map for Oxford City (river flooding)

Taking account of Climate Change impacts when looking at Flood Risk

An important part of predicting likely impact of flooding the future is looking at the likely impacts of climate change. In flood risk terms, climate change is likely to bring increased wetter weather and more incidences of various types of flooding.

The headline findings[18] from the current UK Climate Projections released in 2018 (known as UKCP18) highlighted that in the most recent decade (2009-2018), the UK climate has been on average 1%

[18] https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/key-results

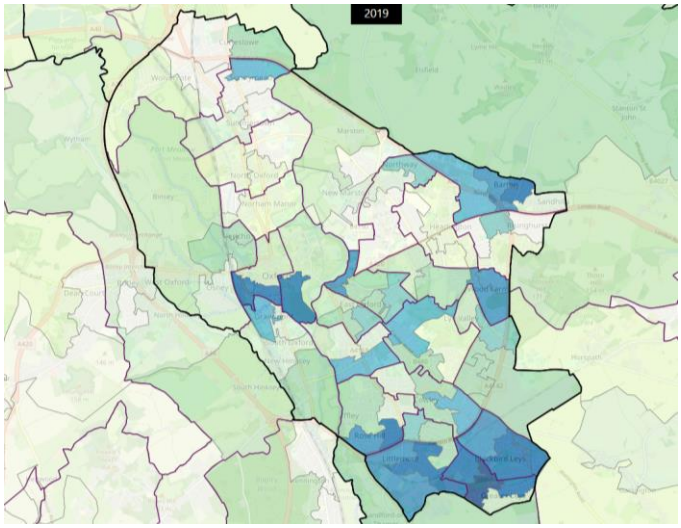
wetter than 1981- 2010, and 5% wetter than 1961-1990. Looking into the future, UKCP18 reported that rainfall patterns across the UK will vary, but that by 2070, under a scenario of high greenhouse gas emissions, winters will on average grow increasingly wetter and summers drier. However, despite overall summer drying trends in the future, there are likely to be future increases in the intensity of heavy summer rainfall events, particularly for urban areas in the UK, which will have an impact on the frequency and severity of surface water flooding.

To take climate change into account in planning for flood risk we utilise allowances produced by the Environment Agency which are applied to existing flood data to determine the future extent of flood risk. In Oxford's Local Plan 2036, we looked at the implications of climate change on a site-specific basis as part of gaining a clear understanding about whether development proposed in higher-risk flood zones would be safe, as well as meeting the other tests set out in national policy. Climate change allowances were applied to all site allocations assessed as part of the Level 2 SFRA.

Links between Flooding and Deprivation

There is a certain degree of overlap between areas of deprivation (as shown in Figure 3) and areas of flood risk (as shown in Figure 2). The darker areas on the map below show those areas that are more deprived. Risks of flooding are often compounded by socio-economic deprivation where people may have less ability to recover from flooding, due either to the cost of increased insurance premiums or to increased levels of mental health which can be worsened through the stress of flooding. Areas of the city that suffer from both flooding and higher levels of deprivation include Blackbird Leys, Greater Leys and parts of the city centre.

Figure 3: Indices of Multiple Deprivation Map19 of Oxford (2019)



Likely trends without a new local plan

Flood risk from a range of sources will be an ongoing challenge in the city. Climate change is projected to bring about wetter winters and more incidences of high intensity rainfall events, which

[19] http://dclgapps.communities.gov.uk/imd/iod_index.html

is likely to increase the risks of flooding, particularly in highly urbanised parts of the city and within the flood risk zones.

In the absence of new local plan, local flooding policy would still be in place as long as the plan remained "up-to-date" and expire in 2036. In the absence of an up-to-date local plan, development control decisions would need to be made against the national framework. As the NPPF (at present) contains a strong policy framework at the national level for flooding, it is unlikely that new or existing development would be adversely impacted on by this change. However, the recent Planning White Paper makes limited reference to flood risk other than seeking a greater standardisation of technical supporting information, so it is difficult to gauge whether this position would be maintained going forward.

More locally, the Oxford Flood Alleviation Scheme (OFAS) is a fully funded infrastructure project and there is a strong desire to see it delivered in a timely manner. The OFAS will create a new stream with wetland wildlife corridor to the west of Oxford.

The intention of the scheme is to reduce flood risk to all properties in Oxford currently at risk of flooding from the River Thames, as well as to the railway, Botley and Abingdon Roads, other local roads, utilities and services such as broadband. The scheme will also bring additional environmental improvements to the area, including creating new wetland which will link up existing wildlife sites. The scheme will be approximately 5 km long, starting just north of Botley Road and passing under the A423 Kennington Railway Bridge (Southern by-pass) to the south before re-joining the River Thames.

Earlier this year the Environment Agency withdrew the planning application for the OFAS in light of the repairs needed to the A423 Bridge. They intend to submit a planning application later this year[20]. The scheme retains the same overall design as in their previous planning application, with necessary changes made around the A423 bridge area. A public consultation was held during the last two weeks of May 2021 to allow the public to ask questions about the scheme.

However, even with flood defences in place, an element of residual risk will remain in areas that are prone to flooding. Residual risk can arise from the failure of flood management infrastructure such as a breach of a raised flood defence or blockage of a surface water conveyance system.

Considerations for the new Local Plan

Nationally, there has been growing recognition of the need for adapting development to build resilience to flooding, so that residents are able to recover more quickly and easily when it happens. The National Design Guide (2019) touched upon this with paragraph 97 providing examples of adaption measures such as including a terraced open space where lower levels may become a water feature, or homes with habitable rooms lifted above the flood level. Overall, however, national policy remains relatively unchanged in its expectations for managing flood risk and the mechanism by which flood risk is tested through the development of Local Plans or through development

[20] https://consult.environment-agency.gov.uk/thames/oxfordscheme/

control decisions. Changes to the national flooding policy approach, as part of the proposals for reforming the planning system, will need to be monitored.

The new Local Plan will need to continue to take a strong approach to managing flood risk in the city. The current approach to flood risk in Oxford is in accordance with National Policy and has been informed by the Strategic Flood Risk Assessment. The sequential test undertaken for that work showed that Flood Zone 3a is an appropriate location for some residential development. The Oxford Local Plan 2036 contains policies that allow for sites in Flood Zone 3b to be developed on the provision that proposals meet all of the criteria contained in Policy RE3.

The Environment Agency have updated their Flood Model since the production of the SFRA that supported the Local Plan 2036. Work has also taken place to update the national climate change allowances which are an important input into the SFRA process. Policies and assessments for the Oxford Local Plan 2040 will need to reflect the current modelling of flood risk for the area now and into the future, and the Environment Agency's most up-to-date allowances for climate change. Guided by the most current flood risk modelling, as we work on allocations for development, we will need to ensure that we have taken a sequential approach to these allocations taking account of any present day and future flood risk where this is identified and cannot be avoided. We will also need to work closely with colleagues working on drainage and flood risk internally, as well as with members of the Environment Agency to ensure that the approach is sound.

Ultimately, the Local Plan will need to continue to balance the need to protect existing homes and businesses from flooding events with the need to deliver new development in the city in a safe and resilient way that does not exacerbate flood risk elsewhere. We will need to continue to address flooding from all sources as part of the Local Plan process and in dealing with development proposals at application stage whilst taking into account any increases in flood risk as a result of climate change. The following are possible areas for officers to explore as part of the flood policy and more widely in the Local Plan to address the issue of flood-risk management.

- The need for taking account of and addressing present day flood risk, as well as future flood risk on and around the city.
- Incorporating flood resistance (dry-proofing/keep water out) and resilience (wet-proofing/allow quick recovery) measures as part of the design of new development.
- Evacuation plans, alert systems, agreed with emergency services.
- Addressing residual flood risks such as those in areas that currently benefit from flood defences.
- Requirements for Sustainable Drainage Systems (SuDS) and other green infrastructure features to reduce surface run off and act as natural flood storage measures within the environment.
- The need to ensure that new development does not increase water inputs into sewer system and overland run-off
- Assessment of allocation sites in light of the various flood risks now and in future via a Strategic Flood Risk Assessment.

Conclusion

Oxford is challenged by flood risk from a range of sources which is likely to increase in the future in light of the projected impacts from climate change. Thus flood risk will be an important issue for the new Local Plan. The city is highly constrained but also needs to accommodate new development into the future as the city grows, including to meet the city's ongoing housing need. The Local Plan will therefore need to balance competing development needs whilst ensuring that flood risk is appropriately mitigated and managed so that the health and wellbeing of residents and the wider sustainability of the city is not compromised.

By addressing flood risk, we can contribute to the social dimension of sustainable development by helping to preserve the health and wellbeing of residents who could otherwise be physically and mentally impacted by having their properties flooded. Addressing flood risk will also have economic benefits through avoiding costs from flood damage to properties and businesses and building up their resilience to future events, whilst it will also help to preserve the environment of the city, including sensitive habitats.

Sustainability/Plan issues

- Between 2,000 and 5,000 properties in Oxford are at risk from river flooding, and additional properties are at risk of groundwater, surface water and sewer flooding.
- The Local Plan 2040 will need to take long term flood risk into account, including the impacts of climate change and how this could change flood risk in the city.
- Avoiding, managing and mitigating flood risk as part of new development includes ensuring that new development does not exacerbate flood risk, such as through hard surfaces increasing surface run off into sewers.
- There are links between flooding and human health (physical and mental) particularly in areas of the city that are most deprived.
- There will be residual risks of flooding after applying the sequential approach to locating development and incorporating defence measures.