OVERVIEW & SCRUTINY COMMITTEE	Agenda Item 38 Brighton & Hove City Council

Subject:		Risk of Flooding affecting Brighton and Hove		
Date of meeting		25 November 2015		
Report to:		Overview and Scrutiny Committee		
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Ward(s) affected:		All		

Introduction by Robin Humphries (Emergency Planning and Resilience Manager)

This report is prepared following a request from the Overview and Scrutiny Committee to examine the risk of flooding for the City of Brighton and Hove.

The Civil Contingencies Act 2004 places a statutory responsibility with the Council to prepare plans and respond to incidents of flooding.

The Flood and Water Management Act 2011 designates the Council as a Lead Local Flood Authority.

The Community Risk Register has assessed the risk of flooding as follows:

- Fluvial (river flooding) – low risk
- Coastal flooding – low risk
- Surface Water flooding – higher risk
- Ground water flooding – higher risk (but limited to specific identified areas)
- Sewer flooding – higher risk
- Flooding from a burst water main – low risk
- Flooding from snow melt – low risk

We therefore focus our efforts to reduce the risk of flooding from the high risk causes, and prepare emergency plans to reduce the impact of flooding should it occur.

A limited stock of sandbags, pumps and other flood prevention equipment is held in reserve and can be deployed if there is an operational benefit in so doing.

The use of sandbags whilst providing a visual re-assurance can often be counterproductive, and we therefore only deploy them to areas that are considered to be at high risk, and there is a a clear operational benefit in using them. These

areas are surveyed by our engineers during the stage where we prepare the 'flood plan' for that area.

The Council also has established plans to care for residents should there be a need for them to evacuate their homes during flooding, or the threat of flooding.

Report prepared by Maggie Moran, BHCC Flood Engineer

Flooding in Brighton and Hove City

Brighton and Hove City Council is designated as a Lead Local Flood Authority (LLFA), under the Flood and Water Management Act

There are no designated main rivers, or ordinary watercourses, within Brighton and Hove, although the City area shares approximately 14km of its boundary with the sea. The topography of the administrative area varies due to its proximity to the Downs in the north and the coast in the south. Situated on the south of the South Chalk Downs, the geology of the area is dominated by the South Downs Chalk, with isolated pockets of clay, silt and sand lying in the south west of this area. The chalk layers of the South Downs are covered by generally shallow and well-drained topsoils, which allow rainfall to quickly seep into the chalk aquifers below.

There has been a wide range of flooding events within Brighton and Hove over the last 15 years with surface and groundwater flooding being the most notable sources of flooding. The autumn and winter event of 2000/2001 is the largest recorded event when extreme weather conditions caused flooding across the City. This section considers historical flood events and future risks of surface water, groundwater, tidal and sewer flooding. This information has been taken from the Brighton Strategic Flood Risk Assessment[1], which takes into account all sources of flooding and climate change.

The most recent significant flooding event occurred on 13th August 2015 and 28th July 2014, where predominantly basements, were affected by surface water flooding following heavy rainfall in a short period.

Surface Water Flood Risk

This is a particular concern in urbanised areas, where floods occur quickly in response to heavy rainfall events. In general, surface water flooding is the most frequent cause of flooding, although floodwaters are typically shallower and persist for shorter durations than other types of flooding.

The SFRA (2008) reported the historical surface water flooding events recorded back to the 1960s, which were sometimes referred to as 'muddy floods'. An indication of those areas which have suffered from this type of flooding was also

[1] http://wastelocalplanescc.brighton-hove.gov.uk/downloads/bhcc/ldf/Strategic_Flood_Risk_Assessment_Jan_2012.pdf

plotted. It was thought that the increase in muddy floods in this area may be as a result of changes in the farming methods used.

An assessment for the potential for surface water flooding in Brighton and Hove has been carried out using EA surface water datasets including Areas Susceptible to Surface Water Flooding (AStSWF), Flood Map for Surface Water (FMfSW) and updated Flood Map for Surface Water (uFMfSW).

- 1 in 30 year flood map
- 1 in 100 year flood map
- 1 in 200 year flood map
- 1 in 1000 year flood map

Areas susceptible to surface water flooding

There are eight well defined flow routes within Brighton and Hove according to the uFMfSW. The largest affected areas are along the A23 and A270 which form a 'y' shaped flow route in the centre of the city. There are significant areas in Hove, which are more susceptible to surface water flooding. The largest area of surface water ponding in Hove lies between the A270 to Kingsway.

The Preliminary Flood Risk Assessment (2011) carried out by the City Council has summarised the properties at risk of surface water flooding in Brighton and Hove in a 1 in 200 year event from the FMfSW, this has been reproduced in Table 1, below.

Table 4.3: Properties at Risk of Surface Water Flooding Risk in Brighton

FMfSW Depth	Total number of properties at risk of surface water flooding	Number of residential properties at risk of surface water flooding	Number of non-residential properties at risk of surface water flooding	Number of people at risk of surface water flooding. (Human Health Consequence)
'Surface Water Flooding' >0.1m	35,600	31,300	4,300	73,242
'Deeper Surface Water Flooding' >0.3m	17,400	15,200	2,200	35,568

Properties at risk of surface water flooding in a 1 in 200 year event- these numbers have been derived using broadscale modelling, and have been reproduced from the PRFA (2011)- Source Table 5.1 Brighton and Hove PFRA, 2011)

The Surface Water Management Plan identifies seven ‘hotspot’ sites as remaining at highest risk of future flooding. This then identifies measures that could be taken at each site, leading to an agreed preferred option. The hotspot sites are:

- Mile Oak
- Bevendean
- Patcham
- Carden Avenue/Warmdene Road
- Moulescombe Primary School/Lewes Road
- Ovingdean – Ketts Ridge
- Blatchingham Mill School

Schemes to reduce flood risk for Patcham and Bevendean are programmed for the 2016 – 2019. BHCC have also been allocated funding in 2016-2017 for a property level protection scheme in Hove and Portslade following the events of July 2014.

Groundwater Flood Risk

Brighton and Hove lies on the south of the Chalk South Downs and has suffered flooding from groundwater in the past. The most notable and largest events in recent years occurred in 2000/01. This resulted in extensive flooding of the A23, which was closed for several days. An assessment of groundwater flood risk in Brighton and Hove has been undertaken using the Environment Agency's 'Areas Susceptible to Groundwater Flooding' data.

The geology within the administrative area of Brighton and Hove is very much dominated by chalk, with isolated pockets of clay, silt and sand lying in the south west of this area.

In February 2014, Brighton &Hove experienced high groundwater levels, which affected a number of properties, infrastructure and the Brighton to London rail line.

BHCC has a Multi Agency Flood Plan, which provides information on how we BHCC respond and manage a groundwater related flood incident in Brighton and Hove City.

Sewer Flood Risk

Sewer flooding can occur where sewage is unable to drain away in sewerage pipes, and emerges at the surface usually due to the system being overloaded with floodwater. In Brighton and Hove, storm water is generally drained by the sewer infrastructure; the system is at risk of becoming overloaded in storm conditions. The infrastructure is also at risk of becoming inundated with groundwater when groundwater levels rise.

Coastal Flood Risk

Brighton and Hove's coastline extends from Shoreham Port in the west to Saltdean in the east. Much of the area at risk from tidal flooding is protected by flood defences. Tidal flooding then is flooding caused by extreme tide levels exceeding ground levels.

In general, there are only two main areas of tidal flood risk throughout Brighton and Hove: Portslade-by-Sea - including the eastern arm of Shoreham Harbour and Brighton Marina. However, the Brighton Marina company monitors and maintains its own defences, which are funded by the residents and businesses within the site. As such the minimum standards of protection will continue to be maintained.

Tidal flooding along much of the south coast is characterised by the presence of risk associated with wave overtopping, which is when there is a transfer of water from the sea onto the coastal floodplain. In exposed locations along the coast, landward flooding is more likely to occur as a consequence of wave overtopping than inundation. Wave overtopping is of material concern to the coastal frontage of Brighton and Hove; therefore any future development proposal should be accompanied by a flood risk assessment, which appropriately considers the effects of wave overtopping.

The most recent event occurred on February 14th 2014, where wave overtopping affected premises along the Lower Promenade. Since the event, as part of the DEFRA funded Repair and Renew Grant Scheme, 16 premises have been fitted with flood boards to reduce the risk of flooding to their businesses.

Effects of climate change on tidal flood risk

For Brighton and Hove study area the climate change outlines from the SFRA (2008) were used. The SFRA (2008) climate change outlines were created by mapping the predicted extreme still water sea-level for 2115 (the 200 year extreme sea level rise was calculated to rise by 1165 mm for 2115 to 5.465mAOD) using LIDAR data supplied by the Environment Agency.

There are three areas along the Brighton and Hove coastline which suffer notable increases in flood extent as a consequence of climate change: Portslade-by-Sea/Shoreham Harbour, Brighton Beach at Palace Pier and Brighton Marina.

The effect of climate change on wave overtopping has not been looked at as part of the existing studies, given that the region is highly susceptible to wave overtopping, it should be noted that the true risk of future climate change is only partially presented.

Report prepared by Stuart Wilson: Highway Asset and Maintenance Manager

Highway drainage

Brighton and Hove as a city is primarily a dense urban authority meaning it has lots of structures and hard landscapes in close proximity to each other. Over the years

the number of buildings and access to these buildings has increased resulting in less natural surface drainage to allow rainfall to permeate through the ground and drain away into the natural chalk; this is most prevalent in residential areas where vehicle ownership has increased considerably in the last few decades and a requirement to have somewhere to park these vehicles is the result. Many properties have therefore 'hard-landscaped' what was their front garden into what is in effect now a car park. The majority of these surfaces are not permeable and many slope towards the highway but do not have a drainage channel at the front edge to catch the surface water running onto the highway.

Highway verges do however form a useful and natural type of drainage and it has been recognised more recently that these should not be hardened to assist with parking problems as had been considered beneficial previously.

The highway drainage infrastructure that was installed when the roads were originally constructed was both comprehensive and to a high engineering standard. However as with all engineered construction, it requires regular maintenance and in situations where the issues above are relevant ie; where more and more water is discharged onto the highway, it needs to be enhanced in order to cope with the increased volumes. This has constantly been undertaken over the years by Hove and Brighton Councils, County and more recently B&HCC. The resultant infrastructure today (there are now over 19'000 gullies and 5'000 soakaways alone in our highway), if working correctly and to capacity, is sufficient to deal with the majority of rainfall even more frequently occurring severe events – some less frequent extreme events excepted of course.

In the outlying areas of the city the highway gullies are connected to soakaways which are large chambers underground that have outlet holes created in the structure. These in effect can take a large volume of surface water quickly if required and this then gradually permeates through the holes into the surrounding natural chalk. In the more central and flatter areas of the city the gullies are connected to what is called a 'combined' system in the vast majority of cases. This is sewerage infrastructure (generally built by the Victorians to a very high standard) that also takes the highway run-off, hence the term combined. Southern Water Services are now responsible for maintaining this infrastructure.

Regular cleansing and maintenance of the infrastructure both B&H's and Southern Water's is essential for the successful drainage of highway surface water. However there are a number of issues that prevent these systems from functioning to full effect, some of which are listed below:

- Leaves – there are 33'000 street trees (not including the privately owned ones) in the city and they produce a lot of leaf-fall which can quickly and easily block a gully grating and even when it mulches down can fill up and block the gully pot and outlet. The roots can also damage the outlet between the gully and either the soakaway or combined sewer.
- Detritus – general dirt, soil, rubbish, oil, restaurant fat/oil and builders material often end up going into a gully and causing it to block, and because parts of Brighton and Hove are quite hilly the water flows faster on the gradients

carrying with it this detritus into the gully rather than deposit it along the highway.

- Utility work – if carelessly undertaken can damage or completely sever the lead (pipe) that runs from the gully to either the soakaway or combined system. This has been found to be a not uncommon occurrence when investigating a blockage.
- Soakaways – these become full and the outlet holes get clogged over time resulting in a lack of initial capacity and making them very slow to drain away naturally.
- Combined system – as stated previously this was built in Victorian times when domestic water usage was considerably less than today and there was a lot more natural surface drainage present. I think it's fair to state that in times of heavy rainfall this system is just not capable of coping with the increased volumes present and no amount of surface drainage infrastructure will remove the surface water if what it feeds into is already full. This is evidenced when the man-hole covers along a road have been lifted off by either water or in some cases water and effluent overflowing from the combined system below.

In summary regular and extensive cleansing along with maintenance of the drainage infrastructure is imperative in order to minimise surface water flooding, however this is both costly and resource intensive and must be balanced against the need to save money and take a pragmatic approach in the current climate.