Hampstead Heath Ponds Project
Meeting to discuss outstanding queries on Design Flood Assessment

19 April 2013, 2pm
Epsom Gateway

Present:

Atkins		
Andy Hughes	AH	Panel Engineer
Tony Bruggemann	TB	Head of Design Team
Margaretta Ayoung	MA	Lead Hydrologist
Mike Woolgar	MW	MD Environment and Water Mgmt
Capita Symonds		
Ivan O'Toole	IT	Cost Consultant/Project Manager
Stakeholders		
Karen Beare	KB	Fitzroy Park RA
Charles Leonard	CL	Elaine Grove and Oak Village RA
Jeremy Wright	JW	Heath & Hampstead Society
City of London		
Richard Chamberlain	RC	Project Liaison, City Surveyors
Peter Snowdon	PS	
Jennifer Wood (notes)	JMW	Communications Officer

Introductions

Meeting started with introductions and it was decided IT should chair. JW's questions would be taken first, followed by those from CL. Harriet King from the Stakeholder Group also had other questions given in writing which would be worked in.

Following the meeting, it was agreed that a non technical preamble to the answers to the questions would assist in conveying the message to the Stakeholders. The preamble is included below.

Hampstead Heath Ponds– Hydrological Problem Statement
The Hampstead Heath ponds, a central part of the special landscape of the heath, were not built to standards to allow large flood volumes to pass without causing collapse. If the water in the ponds overtops the embankments for more than a couple of hours there is a strong likelihood that the earth embankments will erode leading to damage and possible collapse. When the ponds were built the downstream impact of a wave of water might not have been significant but nowadays the area of Camden immediately downstream is densely populated and such a wave presents a risk to life and property. The City of London, as owners of the ponds, must ensure proper maintenance and repair of the embankments to ensure their continued existence and avoid the effects of a collapse of some or all of the dams.

We have established that all of the dams will overtop for rare events above 1:1000 years but some will overtop for events even as likely as the 1:5 year event. This is an

unacceptable level of risk for City of London and they must act to ensure that the dams will not collapse.

How are floods assessed?
Floods are essentially excess water, when the rainfall on an area exceeds the rate at which the land can absorb the rain or carry it away in a river or drain. The main factors which govern the amount of excess water are the amount of rain and the ability of the land to absorb water before runoff starts.

Standard UK information – which relates the location, area and slope of all catchments in UK down to 1km^2 to rainfall events from 1 in 5 year all the way up to the "probable maximum precipitation" - has been used to obtain the necessary hyetographs (rainfall intensities in mm/hr over the period of the storm) for the Hampstead Heath catchments. The probable maximum precipitation is a physical constraint to the water carrying capacity of the atmosphere and, as a credible extreme value, is not sensitive to possible effects of climate change.

The runoff factor for all catchments is also taken from UK information, which accounts for differences in soil type. Although runoff factors are sensitive to the amount of urbanisation, they are most sensitive to the rainfall depth which increases as the rarity of the event increases. Runoff factors for the Heath have been adjusted to take account of local soils and compaction information in accordance with standard UK practice. Factors used are between 53% and 77% for various events which is a credible range; 90-100% runoff is normally associated with completely impermeable surfaces such as concrete and sheet metal, and therefore 90%, as suggested by Haycock, is excessive for a natural landscape like the Heath.

How is the likelihood of overtopping assessed?
The hydrological information, namely hydrographs and runoff factors, are used in computer models representing the physical characteristics of the ponds (area, depth, crest levels, overflow facilities, ground levels) to establish how the chains of ponds respond to the excess water that flows from the surface into the ponds, and then down the chains of ponds. The output of the models shows that the volume of water is significantly larger than the ponds can store for many of the rainfall events and water will overtop the earth embankments.

Sensitivity testing
We have tested the sensitivity of the outputs from our hydrological model by looking at reduced runoff rates in the upper catchment where there is potentially less soil compaction. The output is not sensitive to these marginal effects, or to the capacity of the existing overflow pipes which carry flows of between 1/500th and 1/3000th of the floods examined.

We have also examined how the Kenwood ponds affect the results and can confirm that the overall impact of the Kenwood ponds on the system capacity is very low with modelled water levels varying by between 0 and 20mm. Given the level of assumptions which are made in the assessment of rainfall and runoff this sort of difference can be said to be insignificant.

Overall therefore we are clear that the flood events that we have assessed and the effects of these flood flows on the ponds have been carefully and correctly derived, in accordance with UK best practice and taking appropriate account of locally available information. We have undertaken sufficient sensitivity testing to be sure that the embankments are at risk of overtopping for a wide range of events and that some of these events, although of low probability of happening, will overtop with sufficient depth and for sufficient time to erode the embankments and cause failure.

Questions from Jeremy Wright, Heath and Hampstead Society

Q1. Is calculated percentage run-off into the upper and more sensitive ponds too high?

Answer: MA described percentage run-off and how it had been calculated. AH said Atkins must follow best practice methodology and think of the next Inspecting Engineer – they must be happy with his estimates and must be able to reproduce them in the future. They would follow best practice and take into account local conditions.
KB asked how they had taken into account local conditions?
MA showed on the slides the different catchment areas and how they are cumulative as you go down the chain. She said the Flood Estimation Handbook (FEH) has a high level of detail. The FEH provides depth/frequency curve and it includes rain gauges over a wide area. The point of using a large data set, as included in the FEH information, is it is much more statistically reliable.
JW asked how detailed is the FEH.
MA said data is provided for half km squares.
CL asked if slopes were taken into account.
MA said yes.
MA went on to explain the difference between the Standard Percentage Runoff (SPR) and the Percentage Runoff (PR). The SPR is the runoff associated with the 29 soil types included in the FEH data base. The PR is the estimate of the runoff that would be expected to occur in the field and is calculated by adjusting the SPR by two dynamic factors (copies of pages 26-27 of the Assessment of Design Flood Report were handed out). MA explained that the FEH provides for 29 different soil types (using the UK Hydrology of Soil Type (HOST) values) representing all of the different soil types found in the UK.
MA said 30.97% is the default SPR for Hampstead which is based on the two main soil types that occur in the Heath. The FEH default SPR was adjusted to the local conditions on the Heath by taking account of the area (plus 10m buffer) of footpaths that Haycock assessed as being heavily compacted. This adjusted SPR was carried through to the PR calculation.
KB asked if it included the overlay of geology.
MA - The FEH soil type data base takes into account the geology of the area.
MA said a width of 10 m was added on either side of the footpaths to allow for additional soil compaction on either side of the footpaths. – this was then used to adjust the 30.97% to get 46%. This derived value, 46%, was then increased to a value of 53% as is recommended by the FEH for catchments prone to drying and compaction.

MA responded to JW's query regarding whether the adjustment for compaction should have been used for the upper catchments which potentially have fewer footpaths. MA showed the results of sensitivity analyses, which showed that any resulting difference in overtopping depth is not significant.

Q2: When will a Quantitative Risk Assessment (QRA) be available?

Answer: AH noted that the need for a QRA depends on what was necessary to be looked at.
AH said QRA will show the risk of loss of life is more than one person and thus the risk to COL of failure is far too high. The preferred time to do the QRA would be when there are one or two preferred solution and a QRA would be done on the current situation and the new proposal to show the reduction in risk achieved by implementing the project.
JW asked why not do the current situation now?
AH said it could be done now but he was concerned that it would be over-interpreted and is best used for comparison of before and after.
KB said the H&HS is coming from the direction less is more, so they want a baseline.
JW said not only H&HS also Hampstead Garden Suburb are interested in the results of a QRA.
MW said the QRA was useful as long as it is understood it is more for a comparator.
AH said he can start work on QRA as soon as the flood has been agreed.
TB said it would take between 6 to 8 weeks to do this piece of work once the design flood had been agreed.
ACTION: Atkins agreed to do the QRA in six to eight weeks after agreeing the flood

Q3. Can stakeholders have a detailed explanation of the method of calculating 1:10,000 and PMP flows and the peak storm durations?

Answer: MA said the Probable Maximum Precipitation (PMP) was estimated by the Meteorological Office and is based on the physics of the atmosphere – it is an estimate of the maximum amount of water the atmosphere can hold. This exercise was carried out by the Met Office over the whole country and a series of maps for the whole country is included in the Flood Studies Report. The 10,000 year rainfall is based on a statistical examination of rain gauge data for the whole country. For any catchment that you choose you can obtain the 10,000 year rainfall information from the Flood Studies Report. KB asked what weighting was given to local data and if climate change was taken into account.
MA said climate change was not taken into account as these are already extreme events.
CL asked about the EU directive.
MA said EU flood directive is for floods of a smaller return period and the PMF is a flood so extreme that it does not have an adjustment for climate change as is required by the EU directive for smaller floods.
MA said that there was only 100 years of local rainfall data which is too short a record length to use in deriving the extreme floods required for this project. She stated that a common rule of thumb is that the return period which can be reliably derived from a dataset of N years in length, is N/2. Hence for Hampstead Heath the HHSS rainfall data could also be used to reliably derive rainfall depths of up to the 1

in 50 year rainfall. When asked why the HHSS data was not used to provide the rainfall depth up to the 1 in 50 year rainfall, she said the local HHSS 1 in 50 year rainfall depth agrees with the FEH 1 in 50 year rainfall depth for the 24 hours duration storm, so the local data would not make a meaningful difference for these short return period floods.

POST MEETING NOTE: In addition, the HHSS rainfall data is daily total rainfall and the flood estimation for Hampstead Heath requires sub-daily data (because the critical storm durations are of a few hours rather than days), so the HHSS data set could not be used in any case on its own.

Q4. JW was surprised that the PMF/1:10,000 ratio at the bottom dams results in ratios of 2.12 and 2.22, bearing in mind that ratios on some dams in other parts of the country can be much lower, e.g. Tilgate Dam PMF is only 1.14x10,000 year flood. Why does the Heath have what appears to be an unusually high ratio?

Answer:
MA and AH explained that there is no fixed ratio between the 10,000 year PMF peak flow. The ratio is a function of the physical characteristics of a given catchment. Floods and Reservoir Safety provides approximate guidance and suggests a ratio of 2 which is close to ratio Atkins obtained on the Heath.
AH added that the floods at Tilgate would be influenced by the presence of the M23 and the reservoir chain is much smaller than on the Heath. AH confirmed that he is happy with the ratio for Hampstead Heath.

Q5. What detailed work has been carried out by Atkins to demonstrate that flows into the Stock Pond are not over-estimated? Please give details of the modelling done on the Kenwood Ponds

Answer: AH said the Kenwood ponds had been modelled to assess how much water they would store during the PMF event and it was found they would provide negligible storage so the effect of them would be insignificant.
AH said output from the modelling of these ponds could be shown to the stakeholder group.

MA showed a table of results which showed that when the storage of the Kenwood Ponds is taken into account, the depth of overtopping at Stock Pond changed by 10mm to 20mm, thus showing that the influence of the Kenwood Ponds is negligible.

Q6.H&HS believe the run-off taken for the Highgate slopes is far too high and account needs to be taken of the fact that much of the area described as urban is in fact of rural character (large gardens) that would absorb much of the water. Also asked why the urban catchment percentage for the Ladies Pond is higher than Stock pond.

Answer: MA responded that the catchment areas used to derive the floods are cumulative so that urban extent values were for the cumulative catchments and not the intermediate catchments which JW was describing. This is why the urban extent value generally increases as you go down chain. Gardens have been taken into account as FEH urban extent value is comprised of values for urban as well as

suburban grid cells based on a half a kilometre square resolution. FEH therefore preserves the green areas within each 0.5 kilometre square cell if the cell is not 100% covered by urban landuse and treats urban and suburban differently. In addition, the urban extent has been updated using OS mapping and there is a facility to update urban extent to take account for urbanisation since urban extent was derived.

Q7. Stakeholders would like further details on the rate of release from the scour pipe of Highgate No. 1 Pond.

Answer: AH said the estimated rate of release from this pipe is 10 litres per second and it would take 15 hours to get the water level down 0.4m. The PMF flood peaks at 32000 litres per second.
CL asked if the scour pipe would be removed as Simon Lee had indicated it might not form part of the final design.
AH said he had no intention of getting rid of the scour valves, as there was no reason to do so and they are useful for normal circumstances
CL asked how often the valves had been used to release water downstream.
AH said he was not sure – anecdotally he had heard they had been used a couple of times in the past.
PS said the City would probably not have that information but he had also heard anecdotally they had been used a few times.
AH said he opens the valves every six months when he inspects the dams.

Q8. H&HS said Atkins have rejected spillways which would follow small natural "valleys" on the sides of some of the ponds, and asks why?

Answer: AH said nothing had been rejected as the project was not in the design stage. The decision on what sort of spillways has still to be made.
JW said he would like clarification on some of the terminology used, particularly around spillway. Natural spillway / grass spillway.
Atkins said they would be consistent in future about their description of spillways.
It was agreed that an illustrated guidance note would assist the stakeholders in understanding the terminology.

Questions from Charles Leonard, EGOVRA

Q1. Do Thames Water/ Camden Council / Atkins /City of London all mean the same when they talk about different event sizes e.g. 1 in 20, 1 in 50 etc.

Answer: Yes they should all mean the same thing. Haycock had made an "off-the-cuff" remark about all of the ponds overtopping in a 1 in 25 year flood. The basis of this remark is not known.

Q2. Can the runoff data for other rainfall event sizes be given to stakeholders?

Answer: ACTION: Atkins will provide the runoff data (in a hydrograph) for a 1 in 5, 1 in 20, 1 in 50 and 1 in 100 year events for each pond.
Harriet King had asked about the overflow pipe and whether it was significant.

AH said Highgate No. 1 has an overflow and a drain pipe at a lower level (which release water at 10 litres per second. AH said the overflow is at high level and is running all the time. He drew a simple plan of the dam to illustrate the point.

Q3. KB said there was some confusion about other large rainfall events that had happened on Hampstead, i.e. 1975 event, 2002 event, 2010 event. Could Atkins work out how much rain had fallen during these large events so it can be communicated to stakeholders and the wider public what has been happening on the Heath.
Answer: MA said that an estimate of the return period for these storms could be made .
ACTION: Atkins to estimate the return period of these storms and share data.

Q4. What is the capacity of the emergency valve system on Highgate No. 1 pond?

Answer: AH said city should have some details of this, which can be passed to stakeholders. The map of the sewers/pipes was discussed and Atkins showed which was the overflow and which was the scour pipe (see Question 7 above). CL advised that he has seen a plan which shows a third pipe.

ACTION: CL to provide a copy of the plan with the third pipe for Atkins.

Q.5 Stakeholders would like verification that situation downstream will not be made worse following the work.

Answer: AH described that any work they do will help the situation downstream as they will be creating more storage area for water further up the chain so it will be released downstream in a controlled manner less than the natural peak rate. This is true for all sizes of storms, including the smaller storm events and not just the ones that threaten dam failure and that this could be verified through the hydraulic model.

JW asked when the written notes from the meeting would be made available.
It was decided that JMW's notes of the meeting would be sent to Atkins for them to add the technical details and this would be done within 10 days.
(Note added by JMW – this needs to be done sooner than 10 days as the note must be included in the papers going to the Management Committee which is taking place on May 2.).

ACTION: Note of meeting with answers written in layman's terms to be shared before Management Committee

JW mentioned the area above Stock Pond where the terrain appeared to be favourable to the temporary storage of runoff and he queried if this had been taken into account.
MA replied that localised micro-topography does not have a significant influence on flood estimates, particularly for the longer return periods and PMF.

Q6. Ian Harrison has questioned whether the catchment boundaries shown in Figures 4-2 and 4-3 have been drawn correctly as visual observations on the ground

suggested more water would flow to Vale of Health Pond and less to Catch Pit than suggested by the boundary shown on Figure 4-3.
MA replied that because the flood estimates have been based on cumulative catchment area above each pond, these variations in the catchment boundaries would have an insignificant effect on the flood estimates. Moreover, that in the context of the size of the catchment area as a whole, the suggested boundary variations would have negligible effect on the estimated flood flow.

Following the technical discussions, communications were discussed and it was agreed that that the team needs to improve the accessibility of their communications.

Meeting ended: 4.30pm