

HOLOCAUST MEMORIAL AND LEARNING CENTRE PROOF OF EVIDENCE – FLOODING AND DRAINAGE

MICHAEL COOMBS MSc DIC CEng FIStructE
27 August 2020

1. Introduction

1.1 Qualifications and Experience

1.1.1 My name is Michael Coombs. I graduated from Cape Town University in December 1971 with a first-class honours degree in Civil Engineering. In 1975 I was awarded an MSc with honours by Imperial College in London, together with a DIC. I hold a graduate diploma in Industrial Administration from Cape Town University and am a Chartered Engineer in the UK, being a Fellow of the Institution of Structural Engineers. I have worked as both a contractor and a designer. I was Senior Partner Alan Baxter and Associates and became Managing Director when the firm incorporated. I sat on the board of the Association for Consultancy and Engineering and chaired its Membership Panel. I am a Design Council/CABE Building Environment Expert and sit on their major infrastructure design review panels.

1.1.2 Over the past 43 years I have been based in London, dealing with UK building and infrastructure projects. I have directed several projects in flood zones in London and elsewhere in the UK. Most notably, we have dealt with a number of sites along the Thames in London where we have produced Flood Risk Assessments.

1.1.3 My experience of dealing with development sites along the River Thames dates back to 1978 when I engineered the Crown Reach Development. This was long before the advent of climate change and when the guardian of the river walls was the Port of London Authority. My firm has built significant flood defences for Meadowhall along the river Don in Sheffield where we witnessed the consequences of sudden flooding and fast flowing river waters.

1.1.4 It is important to realise that flooding is often something that is ignored at our peril, particularly when it has a low probability of happening but where the consequence is potentially catastrophic. The severe floods in 2007 in Gloucestershire, Worcestershire and Yorkshire and 2009 in Cumbria happened after many 'dry' years without significant flooding. They were unexpected and resulted in significant damage and human suffering. Out of sight should not be out of mind as far as flooding and flood risk are concerned.

1.2 Declaration

1.2.1 The evidence which I have prepared and provide for this appeal reference APP/X5990/V/19/3240661 is true. I confirm that the opinions expressed are my own independent professional work, based on my knowledge and experience of working on development proposals for sites on the river Thames in London and elsewhere in the UK that have a risk of flooding.

1.3 Instruction

- 1.3.1 I have been asked to offer my evidence by Save Victoria Tower Gardens. I have responded to their request because I believe that the site that is being pursued for the Holocaust Memorial and Learning Centre is inappropriate for such a sensitive development.

1.4 Scope of Evidence

- 1.4.1 My evidence will focus on flooding and flood risk. I have also made some comments on the drainage proposals.

2. Background and Context

- 2.1 A UK Holocaust Memorial and Learning Centre is, without doubt, one of the most significant public projects currently being planned in London. It deserves and demands the highest level of consideration in the selection of the site and in developing a design that is problem-free as well as appropriate to the brief.
- 2.2 It is therefore surprising that a site has been selected and a design developed that is problematic in relation to a key flooding consideration.
- 2.3 It appears that the site may have been selected without full consideration of all issues and alternatives, as should be done when projects of this scale and significance are being promoted.
- 2.4 The applicant has set out what was done to identify, consider and evaluate other sites from an environmental perspective. This information was not provided in the original planning application documentation. A key issue, breach flooding, and the safety of the occupants in the event of such a flood has not been addressed.

3. General Observations on Flooding at VTG and in relation to the proposed development

- 3.1 Because the development causes harm to a public park, it has been conceived as a largely below ground facility in order to minimise the loss of green space. The layout and configuration of the proposed development, with all of the space below ground and with an entrance that is set at a level below the highest predicted river levels, is the main cause of concern and source of problems when it comes to flooding considerations. Others will comment on the planning policy issues, but there are serious problems associated with building large underground public spaces in an area where there is a risk of flooding; in this case breach flooding, which is the failure of the river flood defences when water levels in the river are higher than the level of the site. This is particularly important where there could be a total lack of control of flood waters that might flow into the basement area. This is a problem inherent in the design of the Holocaust Memorial as it is proposed on this site.
- 3.2 London is well defended against flooding, so the risk of flooding is low. The low risk relies on proper maintenance and functioning of the flood defences which are the Thames Barrier and the River Walls. Therefore, when considering development in London on sites within the defended areas, the possibility of failure of the defences, in particular a local failure of a river wall (known as breach flooding) has to be considered and dealt with.

- 3.3 Climate change is a very significant issue in relation to flood risk and flooding. The peak river levels in the Thames are predicted to rise significantly in future as a result of climate change. The EA have published a strategy of raising the river walls along the tidal section of the Thames to defend against raised river levels up to the year 2100. By then they expect the peak river levels to rise by up to 950 mm. When this river level is reached, it will be more than 1 metre above the general level of Victoria Tower Gardens and the entrance to the below ground areas of the Holocaust Memorial and Learning Centre.
- 3.4 According to the Environment Agency (EA), Victoria Tower Gardens and its environs is at risk of breach flooding. The EA have published maps that show this breach flooding. They are provided in Attachment 1 of this document. Breach flooding would be an extreme event (one with a low probability), but one that would have a significant, even catastrophic consequence for the development and its occupants. A breach event could occur when the river levels in the Thames exceed the level of the site. The cause would be a failure of the structure of the river wall, (this was the cause of the disastrous flood of London in 1928 when part of the Embankment close to Victoria Tower Gardens collapsed when there was a high river level) or it could be caused by an impact from a vessel or debris in the river. Although such an event would be rare, it has to be seriously considered by the promoters of the scheme. In none of the work they have done has this aspect been properly considered or addressed.
- 3.5 There are some references in the flood report to there being a need to incorporate safe escape routes into the design. There are problems with this approach. It is entirely unrealistic to expect a large number of people to escape to a refuge or to the surface when floodwater is rushing into the basement area without notice. In any event there are no such refuges or egress routes that would not be flooding in a breach flooding event. The EA confirm this in their letters to Westminster City Council of 9th August 2019 and 2nd December 2019.
- 3.6 The only way to deal with the issue in relation to the design as it is proposed, would be to close the below ground facility whenever the water levels in the river Thames are predicted to be approaching the level of the entrance threshold (4.75m AOD), so that in the event of a breach flooding incident, there would be nobody in the basement area if and when it became inundated. At present water levels in the Thames at Westminster rarely reach this level. Available data suggests that over the last 7 years, the river levels at Westminster would have been this high on 6 or 7 occasions. Closure of the Memorial at this frequency would be an inconvenience. In the year 2100, because of climate change, flood conditions in the River Thames will be much higher with more frequent high river levels. The Environment Agency's Thames Estuary 2100 requirements are based on increasing river levels in River Thames, with the river walls raised to be able to defend against these increased levels.
- 3.7 At Westminster the existing river wall is set at 5.41m AOD . The extreme predicted water level is 4.84m AOD. In future these river defences are to be raised to 6.35m AOD by 2100, to defend against an extreme water level of 5.79m AOD at Westminster. There has to be a margin for error in flood predictions, so to ensure safety of visitors on the site, the Memorial would realistically have to be closed when water levels at Westminster are predicted to be at or above something like 4.6m AOD. To predict exactly how frequently this will be required is a major exercise. It has not been considered by the applicants' advisors, but is likely to be on many occasions per year as 2100 approaches. This approach seems entirely incompatible with a National Holocaust Memorial which is presumably intended to be accessible at all times without these sorts of limitations.

- 3.8 The applicant has given no undertakings to operate in this way. The expectation of having to do so has not even been mentioned.
- 3.9 It seems that the only way of achieving unlimited access to a basement development on this site would be to raise the level of the threshold of the basement entrance to around 6.1m AOD (i.e. by 1.35m). This would take account of climate change and the Environment Agency's Thames Estuary 2100 requirements. In the event of breach flooding in the Thames at or close to this location, such a raised level of the basement entrance would be above the level of the flood waters, meaning that visitors occupying the basement would remain safe. Many developments adopt this approach with entrances in a raised ground floor that has its level set between 300mm and 600mm above the predicted flood level (taking account of climate change).
- 3.10 At the proposed Holocaust Memorial, such a change in entrance level cannot be made by simple amendments to the design. It would materially change the architectural concept and the applicant's assertion that the Memorial is causing minimal harm to the public amenity of the park. This is not a change that could be made without a new planning application, as it would be fundamentally different to what is currently proposed.
- 3.11 The MHCLG guidance on flood risk assessment methodology (see section 4 below for further details), makes it clear that a flood risk assessment should be appropriate to the scale, nature and location of a development. The Flood Risk Assessment (FRA) work is, in my opinion, not appropriate for a project of this scale, spatial arrangement and significance. It does not consider or reflect the serious consequences if breach flooding were to occur on the site.
- 3.12 There is no coherent holistic document that deals with flooding. There is a series of updates and addenda which are hard to follow. Each iteration was responded to with fundamental objections from the Environment Agency (EA). It is clear that what is a very significant and relevant issue (breach flooding) has not been adequately considered or resolved.
- 3.13 The Environment Agency's objection in relation to breach flooding has not been dealt with, though the EA have now withdrawn their objections to the development. In December 2019, the EA handed the flooding issues over to Westminster City Council providing WCC with a list of issues that they should ensure are addressed.
- 3.14 This list of issues is set out in the EA's letter of 2nd December 2019 to WCC – see attachment 6. Proposed conditions EA1 to EA4 are reasonable and have to be implemented with the EA's involvement. In addition to the conditions there is an important section entitled Further Information on Flood Risk, dealing with the risk of breach flooding.
- 3.15 In this section of the EA's letter, they note that the site lies in Flood Zone 3a and has a high standard of flood defence up to a 1 in 1000 (0.1%) chance of being flooded in any one year. They state that the site would nevertheless be at risk from flooding if there were to be a breach in the defences or they were overtopped. They note that in the event of a breach flooding incident, there is nowhere for occupants to escape to safely that is wholly outside the flood plain. They say that therefore safe refuge has to be provided for occupants within upper levels of the development that are above the breach flood level of 5.8m AOD.

- 3.16 No such upper levels exist in the proposed development, so there are no safe refuge points in the development. The only reference that I have been able to find in relation to Emergency Egress is in paragraph 3.10 of the Accessibility Statement. This deals with Fire Safety, not safe egress in the event of a breach flood event.
- 3.17 The EA conclude their Further Information on Flood Risk with the statement “if you are not satisfied with the emergency access/egress or refuge, then we would recommend you refuse the application on the grounds of safety during a flood event, as users would be exposed to flood hazards within buildings and on access/egress routes.”
- 3.18 WCC are no longer tasked with considering the application. This is now to be determined by the Planning Inspectorate. In these circumstances it would seem desirable that the EA were fully involved, so that the Inspector can be fully informed of what their attitude on this important aspect is.
- 3.19 The consideration of the FRA in the Review of the Environmental Statement by Land Use Consultants completely misses the significance of the breach flood risk and the fact that it is an unresolved issue.

4. The Flood Risk Assessment

- 4.1 Turning now to the Flood Risk Assessment (FRA) in more detail, this has been carried out as if the development was a standard above ground development which it is not. The FRA methodology is set out in guidance published by MHCLG in March 2014 entitled Guidance, Flood Risk and Coastal Change. This guidance largely applies to above ground developments so, needs to be applied with caution to a development which is substantially below ground, especially one that will be accessed by a number of users who may be disabled, vulnerable or infirm.
- 4.2 It is the thrust of National policy that basement and below ground uses should be regarded as falling within a higher level of vulnerability classification, particularly if the basement can contain people who would be unaware of the arrival of a flood and be unable to escape from the occupied areas. This is why basement dwellings in this Flood Zone 3 location would not be permissible at all.
- 4.3 The first step is to establish the Flood Zone within which the site lies. The EA publishes a Flood Map for Planning (Rivers and Seas) that defines the Flood Zones. Victoria Tower Gardens lies in Flood Zone 3a which means it has a 1 in 100 or greater annual probability of river flooding if undefended. In central London, all such sites benefit from flood defences so the flood risk is much lower. The site is not in a critical drainage area, so critical drainage provisions do not apply.
- 4.4 Much of London lies in this flood risk zone. It is protected to a very high standard by the Thames Tidal flood defences i.e. the Thames Barrier and the river walls. These are maintained and operated so as to prevent London flooding when the river is in flood. The assumption is that the defences will not fail in such conditions. One possibility that has to be considered is, local failure of river walls i.e. breach events.

- 4.5 The second step in carrying out the FRA is to decide on Vulnerability which relates to the vulnerability to flooding of the proposed development or building and the consequences of flooding to it and its occupants. So, for example, a self-contained basement dwelling, where the occupants could be sleeping in an area at risk of flooding is categorised as Highly Vulnerable, whereas land and buildings used for agriculture and forestry is categorised as Less Vulnerable (the lowest category for a building).
- 4.6 Choosing the Vulnerability Category is important as it determines how defined tests set out in the MHCLG document are to be considered. Table 3 sets out the process and which tests are required. This is provided in Attachment 7. I shall deal with those tests below.

4.6.1 Vulnerability Category

- 4.6.1.1 There are 5 vulnerability categories. These are described in Attachment 2 in order of significance. They are determined by the use of a proposed development. There is, unsurprisingly, no use listed for a self-contained below ground Memorial and Learning Centre, that can accommodate large numbers of people, so one has to apply some thought to what vulnerability classification should be selected, based on other similar uses and configurations.
- 4.6.1.2 The applicants' FRA simply states that the site is Less Vulnerable (the lowest vulnerability category for a new building), with no proper consideration of the consequences of a flood. This approach would be correct if the development was above ground or it had safe egress to a protected area above the breach flood level. It does not have this arrangement so it is not appropriate to give it such a low vulnerability classification.
- 4.6.1.3 As already noted, basement dwellings, where occupants would be trapped in the event of a flood are classified as Highly Vulnerable, as are emergency dispersal points which are to do with where people can safely escape to and disperse in an emergency such as a flood. Both of these have relevance to the spatial arrangement and use of the proposed development. There is no doubt that in the event of an unexpected flood, occupants of the development would become trapped and unable to get out.
- 4.6.1.4 The More Vulnerable category includes nightclubs and non-residential uses for health services, nurseries and educational establishments. Nightclubs tend to be below ground spaces or else they are more problematic to escape from.
- 4.6.1.5 Less Vulnerable developments are those where escape to refuges or places of safety from within above-ground built space is relatively straightforward.
- 4.6.1.6 Therefore the Holocaust Memorial and Learning Centre should be categorised as Highly Vulnerable or More Vulnerable. In my opinion, it is Highly Vulnerable.
- 4.6.1.7 There are two tests that follow on from the selection of the vulnerability category.

4.6.2 Sequential Test

- 4.6.2.1 This is a test that is applied to all development in areas at risk of flooding. It favours sites with a lower flood risk and presumes a number of sites will be considered, so that the site with the lowest flood risk can be chosen. In low-lying areas of a major developed conurbation (such as London), with good flood defences, the choice of alternative sites is restricted and generally it is accepted that development can be permitted in areas subject to flood risk, as long as the development is appropriately configured. This would generally mean setting the ground floor (and entrance) to the development above the highest flood level and ensuring that any occupied basements are configured so as not to flood. This requires upstands or bunds around openings that lead directly into basements and areas that are below the level of predicted flood waters on the site – something that the Holocaust Memorial does not have and very likely cannot include because of the constraints of the site.
- 4.6.2.2 A development on this site would be technically feasible but should not be regarded as acceptable if it is configured to allow floodwaters to rush in unchecked, as is the case here, making it a vulnerable development. The sequential approach to site selection, having regard to flood risk, should exclude this site from consideration for vulnerable development, ie. a development vulnerable to breach flooding
- 4.6.2.3 The Applicant has not recognised the incompatibility of their design with the breach flood risk to users. Had they done so, they would have made more of an effort to look for alternative sites possibly with alternative designs that would have a lower flood risk – preferably no risk to the occupants. This is essentially what a proper Sequential Test requires.
- 4.6.2.4 Attachment 3 is an extract from the MHCLG guidance on the Sequential Test.
- 4.6.2.5 The applicant's Flood Risk Assessment explains why they did not apply the Sequential Test, having regard to Westminster's SFRA. My view remains that this site, with this design should have been excluded from consideration in favour of another site.

4.6.3 Exception Test

- 4.6.3.1 The Exception Test is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, where suitable sites at lower risk of flooding are not available. In my opinion the Exception Test should have been applied in such a way as to exclude the development on this site. It has not been for reasons explained below.
- 4.6.3.2 The test has to be carried out for developments with a Vulnerability Class of 'More Vulnerable' or higher in Flood Zone 3. By stating, without appropriate consideration, that the Vulnerability Class is 'Less Vulnerable' (which I strongly consider it is not), then no Exception Test is required under the MHCLG's flood risk assessment guidelines.
- 4.6.3.3 If the end use were to be classed as 'Highly Vulnerable', which I believe should be the case here, then the development would not be appropriate where it is proposed and it should not be permitted.

4.6.3.4 For the 'More Vulnerable' classification, the Exception Test is required and two criteria must be considered as follows:

- (i) The wider sustainability benefits to the community should be shown to outweigh the flood risk. The MHCLG guidance emphasises that this is a sustainability test that requires a sustainability appraisal. The applicant's sustainability appraisal (WSP Ltd 2018) does not purport to address this matter. It is difficult to see how the loss of green space and construction in a public park, with significant risk to important established trees could ever constitute wider sustainability benefits to the community, so on this measure alone, the development should not be permitted to proceed. In any event, it is hard to see how any "sustainability benefits" could outweigh the unresolved breach flood risk that I have identified.
- (ii) The development must be safe for its lifetime. What the lifetime of the Holocaust Memorial and Education Centre should be has not been stated, but clearly it is to be permanent, standing alongside the Palace of Westminster which is 250 years old (with some parts over 1000 years old). For the purpose of this part of the test, and to take account of raised flood levels as a result of climate change, it makes sense to look at 2100 as the date for the consideration of safety of the development. The MHCLG guidance requires that the impact of climate change has to be considered in this test. It requires consideration of the design and layout of the proposed development, together with flood warnings and evacuation issues. The nature of breach flooding here is that it is sudden. The EA breach flooding maps (see Attachment 1) reveal that in 2100, a breach in the flood defences at Victoria Tower Gardens would result in water flows of 1.0m depth flowing at 2.5m/s. If the breach was 100m away, the water would reach the development in forty seconds and result in catastrophic loss of life if the Memorial and Education Centre was full of visitors. Forty seconds or any period of that order would be insufficient to evacuate the visiting public to a place of safety. They would be very unlikely to be able to get out of the building even if the alarm could be raised instantly, which realistically it cannot be. One of the EA's recommendations is that the applicant should explore the possibility of a refuge for the public in the event of a flood event. The current design has no such refuge or appropriate flood egress arrangements. There is nowhere where such a refuge could be provided within the development and escape is impossible, particularly for elderly or disabled visitors. On this basis, the development fails this part of the Exception Test and should not be permitted.

4.6.3.5 To summarise, safe access and egress from the Memorial, if there were to be a breach in the river wall close to the site, is impossible. The fast-moving water will inundate the site so quickly that visitors would not be able to get out of the basement before it floods. Even those few who might get out could not escape the fast-flowing flood water. The EA maps show that much of Millbank will be under water flowing at a rate that would sweep people away. The EA commented on access and egress when they were consulted. They expressed concern and noted that it was an issue to be resolved in discussion with the local Planning Authority. This did not happen before the proposals were called in and, without changing the design proposals fundamentally, that would negate much of the Design and Access Statement, (in particular the mitigation of harm to the public park), this issue cannot be resolved.

4.6.3.6 Attachment 4 is an extract from the MHCLG guidance on the Exception Test.

5. The Environment Agency Objections (see Attachments 5 and 6)

- 5.1 The Environment Agency objected to the proposals twice; on 7th February 2019 and again on 9th August 2019 in letters to Westminster City Council. One of their major concerns was that insufficient work had been done to establish the nature and condition of the river wall at Victoria Tower Gardens to be able to demonstrate that it would not be adversely affected by the development. The EA was critical of the assumptions made in the modelling that was done to examine the stability of the river wall and the absence of investigative work to establish details of the construction. These issues have now been addressed by the applicant and are included in conditions that the EA suggest form part of any planning permission.
- 5.2 The EA also had concerns about what would be done if issues with the river wall were discovered during construction, monitoring during construction and vehicular access to build the development, and subsequently for maintenance of the river wall. These have all been addressed by suggested planning conditions.
- 5.3 With regard to the risk of breach flooding, which I have focussed on in my evidence, the EA stated clearly in their 9th August 2019 letter of objection to Westminster City Council, that “if you are not satisfied with the emergency access/egress or refuge, then we would recommend you refuse the application on the grounds of safety during a flood event, as users would be exposed to flood hazards within buildings and on access/egress routes.”
- 5.4 The EA wrote to Westminster City Council on 2nd December 2019 handing the flooding aspects of the proposals to the planning authority, stating that they had withdrawn their objections and setting out the conditions that they required to be attached to any planning permission. In addition to the conditions, they provided a clear statement about breach flooding which I have described in paragraphs 3.14 to 3.17 above. They repeated their recommendation that the application be refused as set out in their letter of 8th August 2019 as I have described in 5.3 above. The EA’s letter is Attachment 6.
- 5.5 The design has not changed. There is no safe refuge and without a fundamental change to the design, one cannot be provided. Safe access/egress routes do not exist as the entire area will be under water in the event of a breach flood. WCC are no longer involved, so presumably this decision is now in the hands of the Planning Inspectorate.

6. Conclusion (Flooding and Flood Risk Assessment)

6.1 The Flood Risk Assessment work is not adequate for a development of this significance. The risk to life as a result of breach flooding is clearly significant but has not been adequately considered. Every test required in the MHCLG guidance suggests either that the development should not proceed on this site, or else restrictions will be required on the use of the Memorial and Learning Centre.

6.2

Test	Applicant	Comment
Flood Risk Zone	Zone 3a	Agreed
Vulnerability Classification	Less Vulnerable	Should be More Vulnerable or Highly Vulnerable
Sequential Test	Inadequate	Alternative sites should be considered or design changed
Exception Test Sustainability Public Safety	Not carried out	Should be carried out Fails Fails unless design is changed or access to the site is restricted when the river levels in the Thames are high

7. Drainage

7.1 The applicant has included details of how they propose the site be drained.

7.2 The foul water is shown connected into the Thames Water Sewer running under Millbank. This sewer appears to be very deep with an invert level some 10m below ground level. This is a major Thames Water Trunk Sewer. Gaining permission to connect into it could be problematic. In my experience Thames Water will not permit a direct connection into such a Trunk Sewer. It may therefore be necessary to connect into a shallower sewer, in a more remote location relative to the site.

7.3 Surface water and ground water that enters the basement (relatively small flows) is discharged into the river. One potential problem with the basement arrangement is that it will change the groundwater regime, which could cause problems for the trees. There is no evidence that this issue has been considered, or how the status quo is to be maintained.

7.4 Apart from the above comments, the proposed drainage arrangement is as one would expect for a development of this type, scale and location.

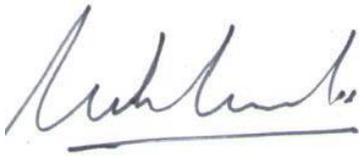
8. Summary

8.1 The proof of evidence focuses on flooding and flood risk.

8.2 The site has not been appropriately evaluated on environmental grounds and considered alongside alternative sites for all relevant issues. Had this been done the significant and unresolved problem of breach flooding would have been identified.

- 8.3 It is the thrust of National policy that basement and below ground uses should be regarded as falling within a higher level of vulnerability classification, particularly if the basement can contain people who would be unaware of the arrival of a flood and be unable to escape from the occupied areas. This is why basement dwellings in this Flood Zone 3 location would not be permissible at all.
- 8.4 There are two distinct aspects to flood risk on this site:
- 8.4.1 The first is the risk of flooding because water levels in the River Thames exceed the height of the defences. The whole of Central London along the course of the River Thames is defended against tidal flooding by the Thames Barrier and the river walls to a very high standard, as one would expect. Overtopping of these defences would be an exceptional event. This could be managed by closing the Memorial to visitors and staff when such very high water levels were predicted by the Environment Agency. It would ensure that nobody would be trapped in the below ground development in such an event. This is therefore a manageable risk as described in paragraph 3.5 of the applicant's FRA.
- 8.4.2 The second flood risk is the risk of breach flooding. This would occur if the river wall were suddenly to fail locally, when water levels in the Thames exceed the level of the site and the entrance to the Memorial and Learning Centre. This would be a sudden and unexpected flood event which cannot be managed in the same way as over-topping of the river defences. In the event of a sudden breach, significant floodwaters could flow across the park and inundate the below ground volume of the development trapping the occupants inside. They would be unable to escape such flooding. This has not been fully considered in the FRA.
- 8.5 The Environment Agency is very clear that breach flooding has to be considered here and have clearly stated that the development should not be permitted to be built if there is a risk to occupants of the Memorial and Learning Centre in the event of breach flooding. They note that in the event of a breach flooding incident, there is nowhere for occupants to escape to safely that is wholly outside the flood plain. They say that therefore safe refuge has to be provided for occupants within upper levels of the development that are above the breach flood level of 5.8m AOD.
- 8.6 The normal way to address this risk is to defend the development against breach flooding by setting the entrance level above the potential maximum water level, which in 2100 is predicted to be at around 5.8m AOD. These levels increase with time because of the rise of river and sea levels as a result of climate change. The development proposals have an entrance threshold of 4.75m AOD, some 1.1m below the breach flood level in 2100, as defined by the Environment Agency.
- 8.7 An alternative way of dealing with the breach risk is to provide safe refuge for occupants of a development that can be reached before it is inundated. This does not exist in the design proposals and neither is it possible to provide it in the design as envisaged.
- 8.8 The only other way to deal with the breach flooding risk would be to close the Memorial and Learning Centre when there is a risk of water levels in the river exceeding the level of the entrance to the development. At present the frequency of closures will be low, but with time, these will become more frequent, as sea and river levels rise with climate change. This approach does not seem credible or appropriate for this important facility and has not been mentioned in the planning application.

- 8.9 The Flood Risk Assessment (FRA) work presented by the applicant does not deal with this breach flooding risk. Neither does the layout of the design address it. Although it is a very small risk, no risk is acceptable, which is why the EA advised WCC to reject the application of the breach flooding risk was not addressed.
- 8.10 The FRA is, in my opinion, incorrect in the way it considers the site's vulnerability and the tests that follow from that. The sequential approach to site selection, having regard to flood risk, should exclude this site from consideration for vulnerable development/development vulnerable to breach flooding as designed. The Exception Test (to look at safety of the users/occupants and sustainability issues) has not been carried out with sufficient rigour. This test leads to the conclusion that the development as configured should not be permitted on this site.

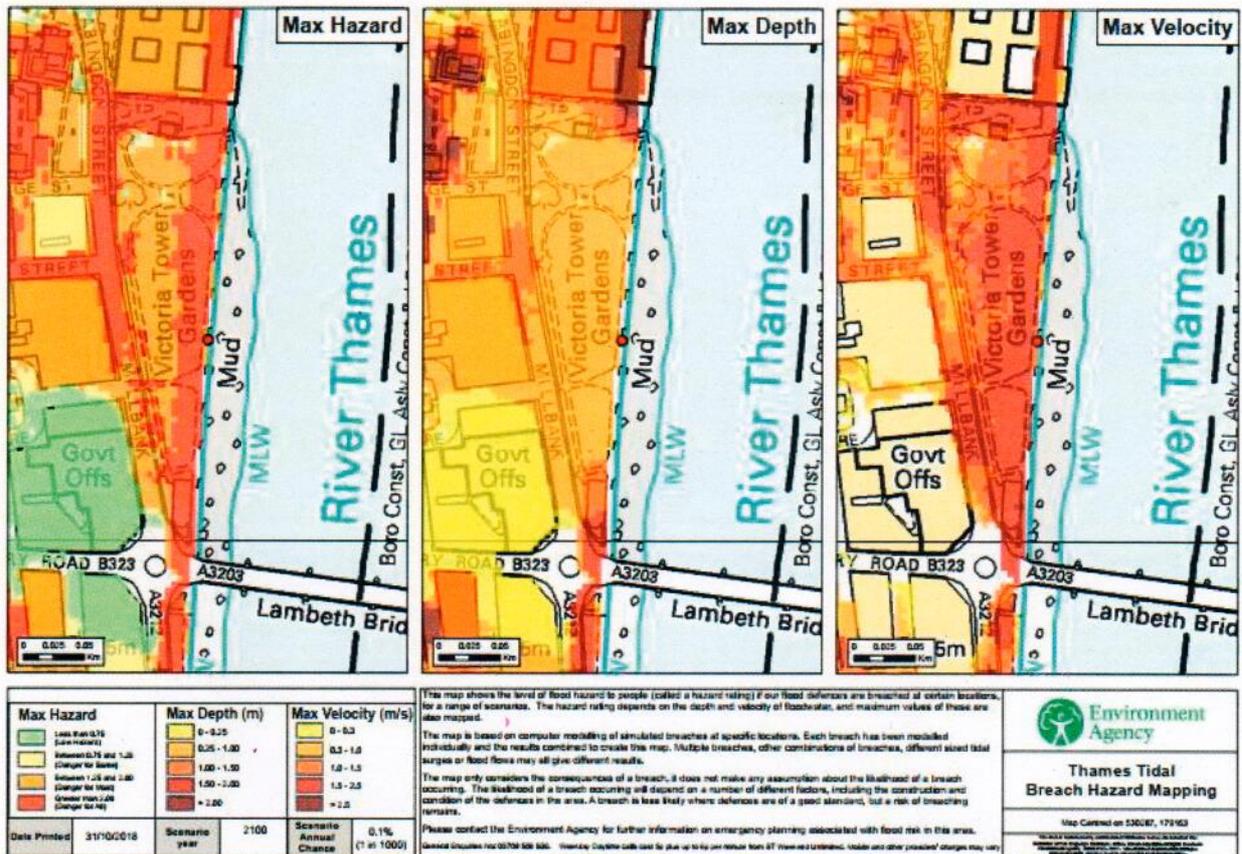
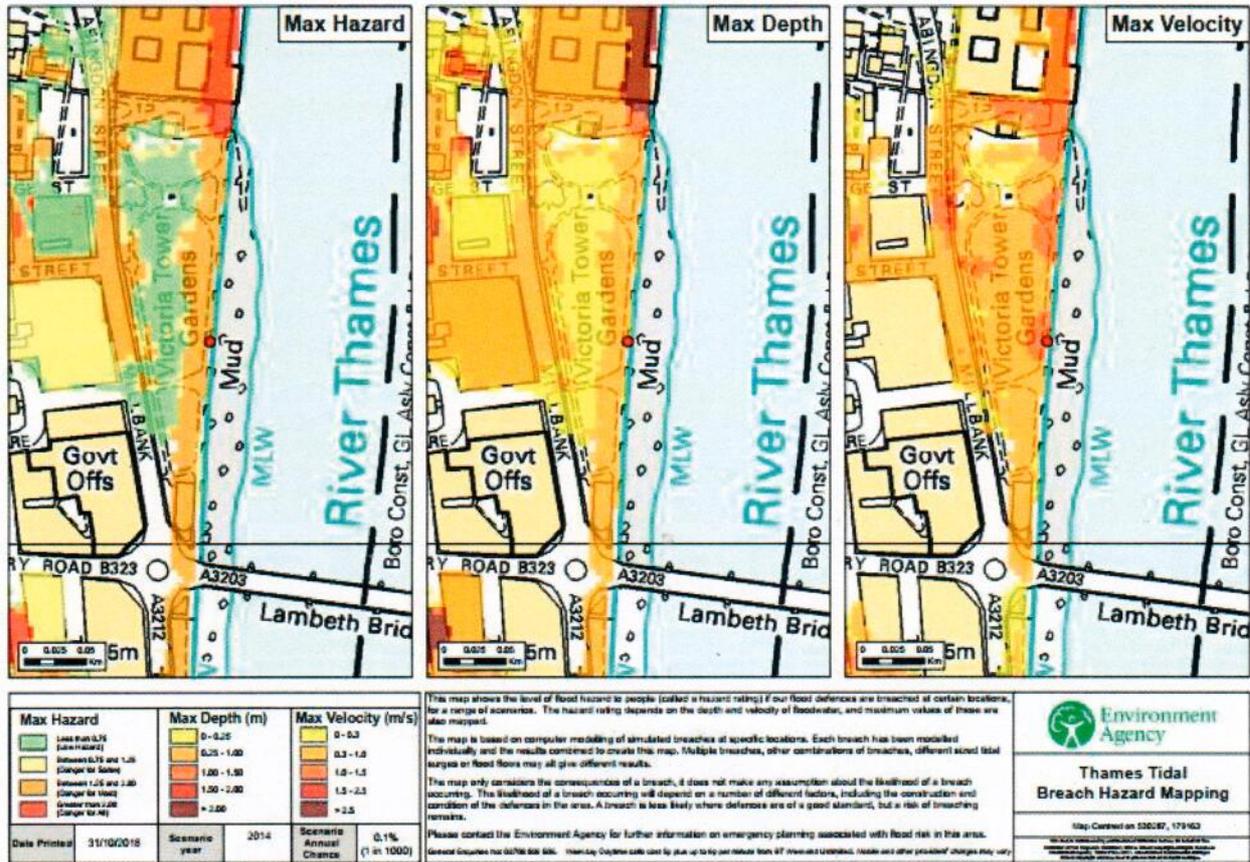
A handwritten signature in black ink, appearing to read 'Michael Coombs', written over a horizontal line.

Michael Coombs CEng FIStructE

Appendix

Documents referred to in preparation of evidence of Michael Coombs

 INTRODUCTION-5782278	21/02/2020 11:39	Adobe Acrobat D...	4,418 KB
 PLANNING_STATEMENT_ADDENDUM-5937742	21/02/2020 11:15	Adobe Acrobat D...	8,679 KB
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 DESIGN_PROPOSALS_PART_7-5782362	21/02/2020 11:40	Adobe Acrobat D...	8,665 KB



Note that in the 2100 scenario the site experiences water up to 1m deep flowing at up to 2.5 m/s. The area is all at significant 'hazard'.

Table 2: Flood risk vulnerability classification

Essential infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines.

Highly vulnerable

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non-residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

” * “ Landfill is as defined in [Schedule 10 of the Environmental Permitting \(England and Wales\) Regulations 2010](#).

The sequential, risk-based approach to the location of development

What is the sequential, risk-based approach to the location of development?

This general approach is designed to ensure that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. The aim should be to keep development out of medium and high flood risk areas (Flood Zones 2 and 3) and other areas affected by other sources of flooding where possible.

Application of the sequential approach in the plan-making process, in particular application of the Sequential Test, will help ensure that development can be safely and sustainably delivered and developers do not waste their time promoting proposals which are inappropriate on flood risk grounds. According to the information available, other forms of flooding should be treated consistently with river flooding in mapping probability and assessing vulnerability to apply the sequential approach across all flood zones.

Waste and mineral planning authorities should apply the sequential approach to the allocation of sites for waste management and, where possible, mineral extraction and processing. It should also be recognised that mineral deposits have to be worked where they are (and sand and gravel extraction is defined as 'water-compatible development' in [table 2](#), acknowledging that these deposits are often in flood risk areas).

However, mineral working should not increase flood risk elsewhere and needs to be designed, worked and restored accordingly.

Mineral workings can be large and may afford opportunities for applying the sequential approach at the site level. It may be possible to locate ancillary facilities such as processing plant and offices in areas at lowest flood risk. Sequential working and restoration can be designed to reduce flood risk by providing flood storage and attenuation. This is likely to be most effective at a strategic (county) scale.

The aim of the Sequential Test

What is the aim of the Sequential Test for the location of development?

The Sequential Test ensures that a sequential approach is followed to steer new development to areas with the lowest probability of flooding. The flood zones as refined in the Strategic Flood Risk Assessment for the area provide the basis for applying the Test. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding). Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.

- Note: Table 2 categorises different types of uses & development according to their vulnerability to flood risk. Table 3 maps these vulnerability classes against the flood zones set out in Table 1 to indicate where development is 'appropriate' and where it should not be permitted.

Within each flood zone, surface water and other sources of flooding also need to be taken into account in applying the sequential approach to the location of development.

The Exception Test

What is the Exception Test?

The Exception Test, as set out in paragraph 160 of the Framework, is a method to demonstrate and help ensure that flood risk to people and property will be managed satisfactorily, while allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available.

Essentially, the 2 parts to the Test require 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.

How can wider sustainability benefits to the community that outweigh flood risk be demonstrated?

Evidence of wider sustainability benefits to the community should be provided, for instance, through the sustainability appraisal. If a potential site allocation fails to score positively against the aims and objectives of the sustainability appraisal, or is not otherwise capable of demonstrating sustainability benefits, the local planning authority should consider whether the use of planning conditions and/or planning obligations could make it do so. Where this is not possible the Exception Test has not been satisfied and the allocation should not be made.

What needs to be considered to demonstrate that development will be safe for its lifetime?

Wider safety issues need to be considered as part of the plan preparation. If infrastructure fails then people may not be able to stay in their homes. Flood warnings and evacuation issues therefore need to be considered in design and layout of planned developments. In considering an allocation in a Local Plan a level 2 Strategic Flood Risk Assessment should inform consideration of the second part of the Exception Test. See further information on making development safe from flood risk and on what is considered to be the lifetime of development.

What is considered to be the lifetime of development in terms of flood risk and coastal change?

Residential development should be considered for a minimum of 100 years, unless there is specific justification for considering a shorter period. For example; the time in which flood risk or coastal change is anticipated to impact on it, where a development is controlled by a time-limited planning condition.

The lifetime of a non-residential development depends on the characteristics of that development. Planners should use their experience within their locality to assess how long they anticipate the development being present for. Developers would be expected to justify why they have adopted a given lifetime for the development, for example, when they are preparing a site-specific flood risk assessment. The impact of climate change needs to be taken into account in a realistic way and developers, the local planning authority and Environment Agency should discuss and agree what allowances are acceptable.

creating a better place



Mr David Dorward
Westminster City Council
Development Control
PO Box 240
London
SW1E 6QP

Our ref: NE/2019/129710/03
Your ref: 19/00114/FULL
Date: 9 August 2019

Dear David,

Installation of The United Kingdom Holocaust Memorial and learning centre including excavation to provide a basement and basement mezzanine for the learning centre (class D1); erection of a single storey entrance pavilion; reprovision of the Horseferry Playground and refreshments kiosk (class A1); repositioning of The Spicer Memorial; new hard and soft landscaping and lighting around the site; and all ancillary and associated works. (The application is accompanied by an Environmental Statement (ES) which may be viewed with the application documents).

The Victoria Tower Gardens, Millbank, London, SW1P 3YB.

Thank you for consulting us on the amended Flood Risk Assessment (FRA) submitted in support of the above application, on 17 July 2019.

The updated FRA titled *United Kingdom Holocaust Memorial and Learning Centre, Environmental Statement (Volume 5), Revised Appendix K Flood Risk Assessment, July 2019, The Secretary of State for Housing Communities and Local Government* (submitted in 8 parts) does not satisfactorily address our earlier concerns.

We therefore **maintain both objections** set out in our response dated 7 February 2019 until the applicant submits a satisfactory FRA. Please see below for reasoning for maintaining our objections.

Objection 1: Climate change

In our response dated 7 February 2019 we objected as the FRA submitted in support of this planning application did not comply with paragraphs 30 to 32 of the Flood Risk and Coastal Change section of the planning practice guidance. More specifically, insufficient information was provided to show how the development would be made safe for its lifetime taking climate change into consideration. Climate change is an important issue in London as the city is heavily reliant on the River Thames Tidal Defences for flood protection. These defences will need to be raised in the future to protect London from rising sea levels in line with Thames Estuary 2100 plan. For this reason development in close proximity to the riverfront (this being one) must be supported by information to show how tidal defences can be raised in line with the TE2100 plan. We therefore requested that the applicant submitted the following additional information to address the issue of climate change:

1. Details showing how the wall, in its raised condition can withstand any additional surcharge loading from the raising of the ground. More specifically, we require calculations to show how the surcharge loading from the ground raising can be offset immediately behind the wall. If calculations show this is not possible, then the applicant would be required to propose an alternative method of raising the defences.
2. Details showing how plant and machinery will access the flood defence to carry out any required works for maintenance for future raising.

The information contained within the updated FRA **does not** fully address this objection therefore further work is required before we can remove this objection. Please see below for further details regarding what the applicant still needs to submit.

Additional information to address objection 1 requirement 1:

An assessment (*United Kingdom Holocaust Memorial and Learning Centre, Ground Movement Assessment – Thames River Wall, 70040431, 0001, May 2019*) has been submitted in attempt to address this information requirement. However, based upon our experience, we feel that the assumptions made within the assessment are unrealistic and mean the modelled scenario is invalid and unacceptable*.

The model in its current form is therefore insufficient to conclude the development will not preclude future raisings. Therefore, as previously discussed during pre-application meetings, site specific ground investigations are required in order to help overcome this aspect of our objection. These ground investigations should determine the extent of the tidal flood defence wall, and utilise this to inform the ground movement model.

This information is essential in demonstrating that that flood defences can be raised in the future, in line with requirements of the Thames Estuary 2100 Plan.

**Please see model assumptions section of this letter for detailed reasoning behind this conclusion.*

Additional information to address objection 1 requirement 2:

The document titled Appendix I Proposed site plan showing vehicle access (UKHM-03-003 Proposed Site Plan Flood Defence Wall Set Back 19/04/11) satisfactorily addresses our concerns relating to the need for access. Therefore no further information is required at this time.

Supporting policy:

The need for this additional information is supported by Policy SI12 of the Draft London Plan July 2019 (in examination) which states that *development proposals should contribute to the delivery of the measures set out in Thames Estuary 2100 Plan*. In addition, Paragraph 160 of the National Planning Policy Framework (NPPF) states (...) *for the exception test to be passed it should be demonstrated that: the development will be safe for its lifetime.*

Objection 2: Integrity of the flood defence

In our response dated 7 February 2019 we also objected as the proposed development would be likely to adversely affect the construction and stability of the flood defence

which could compromise its function. More specifically we had concerns as the submitted 'Riverwall visual Condition Survey' identified repairs that need to be carried out on the flood defence. However, there was no evidence to show that these repair works would be incorporated into the planning application. In addition, the development will require deep excavations in order to accommodate the learning centre and other underground elements of the proposal. These works may adversely affect the construction and stability of the flood defence which will compromise its function. These issues are critical because if the flood defence was to be weakened as a result of the works and breached, the site and surrounding areas will be highly susceptible to rapid inundation. The proposed works could therefore increase the risk of flooding to houses and businesses in the surrounding areas. We therefore requested that the applicant submitted the following additional information to address the issue of protecting the integrity of the flood defence:

1. The applicant would need demonstrate that the repair works will be carried out and the integrity of the flood defence will not be impacted from the proposed development.
2. The applicant will need to set up a monitoring scheme to monitor the structural stability of the flood defences while construction works are taking place.

The information contained within the updated FRA **does not** address this objection therefore further work is required before we can remove this objection. Please see below for further details regarding what the applicant still needs to submit.

Additional information to address objection 2 requirement 1:

Having reviewed the submitted document (*Report ref UK Holocaust Memorial Foundation, Riverwall Visual Condition Survey, Project no. 70040431, our ref. 70040431-C-001, WSP, October 2018*) there is no evidence to suggest that any repairs are to be undertaken to the river wall. To address the outstanding issue it should be demonstrated how and when the applicant will undertake the required remedial work. More specifically, the works outlined within section 6.2 of the document will need to be incorporated into the planning application.

An assessment (*United Kingdom Holocaust Memorial and Learning Centre, Ground Movement Assessment – Thames River Wall, 70040431, 0001, May 2019*) has been submitted in attempt to address the issue of ensuring works do not have a negative impact on the integrity of the flood defence. However, as previously mentioned, the assumptions made within the assessment are unrealistic and mean the modelled scenario is invalid and unacceptable*.

The model in its current form is therefore insufficient to conclude the development will not affect the integrity of the flood defence. Therefore, as previously discussed during pre-application meetings, site specific ground investigations are required in order to help overcome this aspect of our objection. These ground investigations should determine the extent of the tidal flood defence wall, and utilise this to inform the ground movement model.

This information is essential in demonstrating that that flood defences will not be adversely affect as a result of this development.

**Please see model assumptions section of this letter for detailed reasoning behind this conclusion.*

Additional information to address objection 2 requirement 2:

The amended FRA states that a ground movement assessment and monitoring strategy will be submitted in support of this planning application. We welcome the provision of these details however there is no evidence of these documents having been submitted to support this planning application. This should be provided to us for review and comment either through the pre-application advice service or through the statutory process before this part of the objection can be considered address.

Supporting policy:

The need for this additional information is supported by Policy s45 of the Westminster's Local Plan which states '*Development will ensure that flood-related infrastructure is protected*'. In addition Policy SI12 of the Draft London Plan July 2019 (in examination) states that '*Development proposals adjacent to flood defences will be required to protect the integrity of flood defences (...)*'. Finally, Paragraph 163 of the NPPF states that '*When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere (...) and it can be demonstrated that any residual risk can be safely managed*'.

***Model assumptions:**

The as-built drawing referenced in Figure 2-4 provides a base width of the wall as 11 feet (equivalent to 3.96m) not 4.2m width as used in the assessment. It also shows piling at the toe and an unknown amount of mass fill behind. Based on our work with Thames Tideway Tunnel we have found that not all the gravity walls have substantial mass fill behind the toe. The drawing also indicates a 0 meters Ordinance Datum (OD) line, which when comparison is made to the model, more of the gravity wall is above the 0 OD line than below. From our experience not all of the Basalgette walls were built into the London Clay. Therefore, the model has made gross overestimations of the actual depth and width of the gravity wall. We also believe that the ground water level is too low for a conservatively modelled scenario. An acceptable ground water level would be 1m below ground level.

Further information on flood risk:

Although the site is located within Flood Zone 3 and is protected to a very high standard by the Thames Tidal flood defences up to a 1 in 1000 (0.1%) chance in any year flood event, our latest flood modelling shows that the site would be at risk if there was to be a breach in the defences or they were to be overtopped.

This proposal does not have a safe means of access and egress in the event of flooding from all new buildings to an area wholly outside the floodplain. We look to London Borough of Westminster, as the competent authority on matters of evacuation or rescue, to assess the adequacy of the evacuation arrangements. You should consult your emergency planners as you make this assessment.

If you are not satisfied with the emergency access/egress or refuge, then we would recommend you refuse the application on the grounds of safety during a flood event, as users would be exposed to flood hazards within buildings and on access/egress routes. A large portion of the proposal is below the 2100 breach flood level, which is 5.8m AOD. It is therefore highly recommend that Flood Warnings and Alerts are signed up for and emergency evacuation plans are in place, this should be agreed with the Local Planning Authority and emergency planners.

Advice to applicant – Flood Risk Activity Permit:

Under the terms of the Environmental Permitting Regulations a Flood Risk Activity Permit is required from the Environment Agency for any proposed works or structures, in, under, over or within 16 metres of tidal defences on the River Thames, designated a 'main river'. For the avoidance of doubt, the 16 metre easement applies to known ground anchors and tie-rods. Details of lower risk activities that may be Excluded or Exempt from the Permitting Regulations can be found at www.gov.uk/guidance/flood-risk-activities-environmental-permits. Please contact us at PSO-Thames@environment-agency.gov.uk.

Final comments:

If you have any questions please contact me on 0207 7140 578 or email me at HNL SustainablePlaces@environment-agency.gov.uk, quoting the reference at the beginning of this letter.

Yours sincerely

Demetry Lyons
Sustainable Places Planning Advisor

End

Mr David Dorward
Westminster City Council
Development Control
PO Box 240
London
SW1E 6QP

Our ref: NE/2019/129710/04
Your ref: 19/00114/FULL
Date: 2 December 2019

Dear David

On 5 November 2019, the Government notified the Council of its decision to call in this planning application in relation to the UK Holocaust Memorial for a local inquiry. We await further information from the Planning Inspectorate on the call in process and will play our part as necessary. The public will continue to have an opportunity to provide its views on this planning application during this process. Installation of the United Kingdom Holocaust Memorial and Learning Centre including excavation to provide a basement and basement mezzanine for the learning centre (Class D1); erection of a single storey entrance pavilion; re-provision of the Horseferry Playground and refreshments kiosk (Class A1); repositioning of the Spicer Memorial; new hard and soft landscaping and lighting around the site; and all ancillary and associated works. (The application is accompanied by an Environmental Statement (ES) which may be viewed with the application documents) (This re consultation follows receipt of clarifying and further information to supplement the initially submitted Environmental Statement: - Environmental Statement (Volume 5) Revised Appendix F Archaeological Desk Based Assessment - Environmental Statement (Volume 5) Addendum to Revised Appendix K Flood Risk Assessment - Environmental Statement (Volume 5) Appendix M Transport Assessment Addendum - Response to Review of Environmental Statement October 2019).

The Victoria Tower Gardens, Millbank, London, SW1P 3YB.

Thank you for re-consulting us on the above application on 31 October, 2019 following the submission of an amended flood risk assessment (FRA). We have now reviewed the following additional documents:

- The revised FRA - UK Holocaust Memorial and Learning Centre, Environmental Statement (Volume 5), Revised Appendix K Flood Risk Assessment, Revision 3.0, July 2019, (Part 1-8).
- The addendum - UK Holocaust Memorial and Learning Centre, Environmental Statement (Volume 5), Addendum to Revised Appendix K Flood Risk Assessment, Revision 4.0, October 2019, (Part 1-2).

We consider that the submitted documents satisfactorily address our earlier concerns therefore we withdraw our previous objections, dated 7 February 2019 subject to the conditions below being included in any decision notice.

Condition EA 1

No development approved by this planning permission shall commence until a strategy for maintaining and improving the flood defences has been submitted to, and approved in writing by, the Local Planning Authority. This strategy will include the following components:

1. A condition survey of the existing river wall.
2. A scheme, based on the condition survey in (1), to undertake any required improvements or repairs to the flood defence prior to the construction works. The scheme shall include a plan for any required long term monitoring and maintenance and a program for the improvements or repairs completion.

The scheme shall be fully implemented and subsequently maintained, in accordance with the scheme's timing/phasing arrangements, or within any other period as may subsequently be agreed, in writing, by the Local Planning Authority.

Reasons

This condition is required to ensure that the structural integrity of the flood defence is not compromised so that the development can remain safe for its lifetime and to reduce flood risk on site and elsewhere. This is in line with Paragraph 160 of the National Planning Policy Framework (NPPF) and Policy SI12.F of the Draft London Plan (2019).

Please note that the document titled "*River wall Visual Condition Survey*" produced by WSP, dated October 2018 (Report reference 70040431-C-001) satisfies part 1 of this condition.

Condition EA 2

If, during development, additional improvements or repairs to the flood defence not previously identified are found to be necessary, then no further development (unless otherwise agreed in writing with the Local Planning Authority) shall be carried out until a strategy detailing how these additional works will be undertaken has been submitted to and approved in writing by the Local Planning Authority. The strategy shall be implemented as approved.

Reasons

This condition is required to ensure that the structural integrity of the flood defence is not compromised from previously unidentified improvements or repairs. This is to ensure the development can remain safe for its lifetime and to prevent flood risk on site and elsewhere. This is in line with Paragraph 160 of the National Planning Policy Framework (NPPF) and Policy SI12.F of the Draft London Plan.

Condition EA 3

The development shall be carried out in accordance with Appendix I of Environmental Statement (Volume 5) titled '*Proposed site plan showing vehicle access*' (UKHM-03-003 *Proposed Site Plan Flood Defence Wall Set Back 19/04/11*) and shall include the following mitigation measures it details:

- 16m set back from back of granite wall at ground level.
- Vehicle access routes for future wall maintenance and raising works.

Reason:

This condition is required to ensure adequate access is provided for inspection, maintenance, repair, replacement and raising in the future of the flood defences in line with the TE2100 plan. This is supported by Policy SI12.F of the Draft London Plan (currently in examination).

Condition EA 4:

No development approved by this planning permission shall commence until a Monitoring Action Plan (MAP) has been submitted to, and approved in writing by, the Local Planning Authority. The MAP shall be fully implemented in accordance with the scheme's timing/phasing arrangements, or within any other period as may subsequently be agreed, in writing, by the Local Planning Authority.

The MAP shall be based on the approved Monitoring Strategy (Holocaust Memorial Westminster Monitoring Strategy Revision 4 Project Ref: 70043431, Dated 5 September 2019) and will define the trigger thresholds and actions required by all parties if a trigger threshold is exceeded.

Reason:

This condition is required to ensure that the structural integrity of the flood defence is not compromised so that the development can remain safe for its lifetime and to reduce flood risk on site and elsewhere. This is in line with Paragraph 160 of the National Planning Policy Framework (NPPF) and Policy SI12.F of the Draft London Plan (2019).

Further information on flood risk:

The site is located within Flood Zone 3 and is protected to a very high standard by the Thames Tidal flood defences up to a 1 in 1000 (0.1%) chance in any year flood event. However, our latest flood modelling shows that the site would be at risk if there was to be a breach in the defences or they were to be overtopped.

This proposal does not have a safe means of access and egress in the event of flooding from all new buildings to an area wholly outside the floodplain, however, safe refuge within the higher floors of the proposed development is possible. You are the competent authority on matters of evacuation or rescue, and therefore should assess the adequacy of the evacuation arrangements. You should consult your emergency planners as you make this assessment.

If you are not satisfied with the emergency access/egress or refuge, then we would recommend you refuse the application on the grounds of safety during a flood event, as users would be exposed to flood hazards within buildings and on access/egress routes.

A large portion of the proposal is below the 2100 breach flood level, which is 5.8m AOD. It is therefore highly recommend that Flood Warnings and Alerts are signed up for and emergency evacuation plans are in place, this should be agreed with the Local Planning Authority and emergency planners.

Informative:

In addition to planning permission, in line with the Environmental Permitting Regulations (England and Wales) 2016, the applicant will require a permit to be obtained for any activities including remedial works, works to demountable structures adjacent to the Thames tidal flood defence and basement excavation and construction of the memorial and learning centre which will take place:

- on or within 8 metres of a main river (16 metres if tidal)
- on or within 8 metres of a flood defence structure or culvert (16 metres if tidal)
- on or within 16 metres of a sea defence
- involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert
- in a floodplain more than 8 metres from the river bank, culvert or flood defence structure (16 metres if it's a tidal main river) and you do not already have planning permission.

The landward most extent of the flood defence at this site has been determined through intrusive ground investigations and comparison with historical drawings and is detailed in the addendum Appendix J5 "*EA correspondence Memo Ground Movement Assessment, 10 October 2019*".

For further guidance please visit <https://www.gov.uk/guidance/flood-risk-activities-environmental-permits> or contact our National Customer Contact Centre on 03702 422 549. The applicant should not assume that a permit will automatically be forthcoming once planning permission has been granted, and we advise them to consult with us at the earliest opportunity

Advice to applicant:

Should you wish us to review any technical documents or want further advice to meet the requirements of the conditions recommended, we may do this as part of our charged for planning advice service.

Further engagement will provide you with certainty as to what our response to your Discharge of Condition applications will be. It should also result in a better quality and more environmentally sensitive development.

As part of our charged for service we will provide a dedicated project manager to act as a single point of contact to help resolve any problems. We currently charge £100 per hour, plus VAT. We will provide you with an estimated cost for any further discussions or review of documents. The terms and conditions of our charged for service are available [here](#).

If you would like more information on our planning advice service, including a cost estimate, please contact us at hnl sustainableplaces@environment-agency.gov.uk.

Final comments:

Please consult us on the details submitted to your authority to discharge these conditions and on any subsequent amendments/alterations.

If you have any questions please contact me on 0207 7140 578 or email me at HNL SustainablePlaces@environment-agency.gov.uk, quoting the reference at the beginning of this letter.

Yours sincerely,

Demetry Lyons
Sustainable Places Planning Advisor

End

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.