LLFA DRAINAGE COMMENT / QUERY TRACKER - 31.03.2021

INTRODUCTION

This tracker has been compiled to provide a detailed response to comments received by Camden Planning from the Lead Local Flood Authority in relation to the proposed development.

SUMMARY

Earlier (2nd and 3rd) LLFA comments were discussed and informally resolved at a meeting between Coyle Kennedy, LBH and the Camden LLFA Officer on 26th November 2019. The 4th round of LLFA comments, provided by Camden's outsourced LLFA consultant Aecom, were then addressed in a preceding version of this tracker dated 11th February 2020 when it became apparent that Aecom, who had previously provided the 1st comments on behalf of the LLFA had possibly not been involved subsequently in any of the discussion or resolution of the issues dealt with in the 2nd and 3rd round.

A 5th set of LLFA comments on the drainage submission were provided subsequently by Aecom on 10th March 2020, and these were duly introduced and addressed in an earlier version of the tracker. Following a virtual meeting with the Camden LLFA, Aecom, the Corporation of London and the Fitzroy Park Residents Association on 6th May 2020, a final list of outstanding additional information to be provided by the applicant was forwarded by Camden on 3rd June 2020, taking into account the comments of the Corporation of London. The items on that list were discussed and addressed within an earlier version of the tracker issued in August 2020

However, in December 2021 the LLFA responded with a further (7th) set of comments that the applicant felt did not follow what had been previously agreed as the final list of outstanding information. These comments are included in this version of the tracker. On being challenged the LLFA indicated through the planning officer that t all that was in fact required as outstanding at that stage was an indication of the soil permeability.

The applicant duly undertook an indicative test as requested and provided this in in report dated 4th February 2021.

However, in March 2021 the LLFA provided an 8th set of comments from Camden's new outsourced LLFA consultant Metis. These comments are also included in this version of the tracker.

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ISSUE REF:	ORIGINAL LLFA COMMENTS (AECOM) 22/08/2019	APPLICANT RESPONSE 23/09/2019
Issue 1 **(SuDs)**	**Provide the maximum volume each of the SuDS features can accommodate, as well as freeboard requirements in order to verify if the 141.5m3 of attenuation required can be accommodated and indicate the discharge rate from the impermeable driveway to the combined sewer.**	The SuDS volumes are included in the plan on Page 7 (of13) of the CK report which also shows a flow control limiting the discharge rate from the impermeable driveway to the combined sewer at 5 l/sec.
Issue 2 **(Calcs)**	**Provide calculations in demonstration of the discharge rate from the swale and the discharge rate to the combined sewer for the 1 in 1-year event, the 1 in 30 event, the 1 in 100 year event and the 1 in 100 year + 40% CC event.**	Calculations are included on Pages 10 to 13 of the CK report, including discharge rates to the combined sewer for the 1 in 1-year event, the 1 in 30 event, the 1 in 100 year event and the 1 in 100 year + 40% CC event.
Issue 3 **(Heath)**	**Provide evidence of acceptance of discharge proposal to Hampstead Heath from the Corporation of London**	The Corporation of London's requests regarding maintaining the current discharge to Hampstead Heath is addressed on page 1 (Page 3 of 13) of the CK report.

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Issue 4 **(Flood)**	**Outline flood mitigation measures for Plots 4 & 5 to demonstrate how these plots will be mitigated against the ingress of surface water.**	This was actually addressed in our Hydrological & Hydrogeological assessment LBH4480 Ver 2.0 section 7.8 (page 31), where it was indicated that local landscaping would be used to direct any surface water flooding away from Plots 4& 5 and direct this to the designated overland flood route immediately to the north of Plot 5

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LLFA 2ND COMMENTS 04/10/2019	APPLICANT RESPONSE 24/10/2019	LLFA 3RD COMMENTS 08/11/2019	APPLICANT RESPONSE 11/12/2019
Plan shows: • 50 m^3 surface water attenuation • 15 m^3 swale • 3 m^3 underground attenuation tank • Flow controlled rate from driveway 5 l/s Issue i: the indicated storage adds to 68 m3, a shortfall of 73.5 m3. Issue ii: No technical details indicated for the blue-green roofs (storage volume, area/depth, void %, flow controls, discharge rates etc.) Issue iii: no information on freeboard requirements	Issue i: There is a total storage volume of approximately of 141.5m3, which is made up as follows: • 15m^3 in the swale • 50m^3 in the attenuation tank • 76m^3 in green and blue roof storage Issue ii: The green/blue roofs will be designed by a specialist supplier/designer and it is unreasonable to request such details at this time as any specialist supplier/designer is unlikely to carry out a design without first receiving an order and deposit. Issue iii: The proposed house levels for the houses on the east side of the site are in excess of 1m above the level of Millfield Lane. From this it is clear there is more than ample freeboard provided.	Issue i: Noted. The blue-green roof storage information the Drainage Report. At least the Site Drainage Layout should be updated with the figures that make up the 76 m^3. Further action requested Issue ii: Adequate information should be submitted at planning stage, based on outline designs generated by the drainage consultant. This is to show the LPA/LLFA how the proposed drainage measures, rates and volumes could be achieved in the scheme. Final detailed design information is not expected at this stage; it is accepted details may change, but the potential to achieve the stated aims should be demonstrated. Further action requested Issue iii: This request related to the SuDS freeboards as per original comment: "Provide the maximum volume **each of the SuDS features can accommodate, as well as freeboard requirements** in order to verify if the 141.5 m3 of attenuation required can be accommodated and indicate the discharge rate from the impermeable driveway to the combined sewer. Further action requested	Issue i: The roof designs will be undertaken by a specialist designer in due course. At this stage a conservative assumption might be made as follows: Assumed Approx. green/blue roof area Plots 1 to 3 - 80 m^2 each Plots 4 & 5 - 135 m^2 each Assumed equivalent depth water retained 150mm (3 x 80) + (2 x 135) = 510 m^2 510 m^2 x .15m = 76.5 m^3 NB. Coyle Kennedy have provided a further assessment (attached) based upon revised areas that suggests 125m^3 of blue/green roof storage to be potentially available. Issue ii: Coyle Kennedy have provided additional information (attached) to demonstrate how the drainage measures will be achieved. Issue iii: Coyle Kennedy have indicated a surplus storage capacity of some 50m^3. Given that there is no potential for freeboard within the filled swale and the attenuation tank this can be accommodated within the roof designs as a freeboard of some 60mm. (see attached CK detail)

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The Micro Drainage tables show storm sewer design results and foul sewerage design. Issue iv: we should expect, for each return period: - summary of results - rainfall details / time area diagram - model details / storage structure / depth-flow relationship outflow control	The storage provided on site caters for the 100 year return period + 40% CC event which has been demonstrated by LBH Wembley in detail. The system is currently designed for a 100 year return period + 40% CC event – this will clearly cover return period less than the 100 year and clearly each of these return periods will have a lesser requirement than the 100 year period. The proposed drainage system is designed to mimic the existing drainage on the site, except that it in now much improved as additional storage is provided where the water now permeates naturally to the ground via the storage systems. An overflow is provided from the storage systems to the Heath via a pipe as agreed with Mr. Bob Warnock (Camden Council) which will eliminate the current discharge across Millfield Lane and the Health and Safety issue he was concerned about. The details of the storage structures are outlined in Coyle Kennedy's drawings to a level of detail which is reasonable for this stage of the planning/design.	We are seeking copies of the MicroDrainage calculations which will have been carried out by the consultant in order to generate the storage proposals. This is your evidence to support the proposed attenuation volumes and discharge rates. I can provide example copies on request from other schemes but the consultant would be aware of the items requested. Further action requested	Issue iv: See attached updated LSD Proforma and calcs to demonstrate storage required to achieve A. Greenfield Rates - 161m^3 B. 50% Betterment - 143m^3 (it is noted that the previous estimate for 50% betterment was 141.5m^3, and also that the 190m^3 storage proposed by Coyle Kennedy will accommodate the Camden Policy to limit post development discharge to greenfield rates)

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The reference states "….as agreed with Mr. Bob Warnock on site on the 10 May 2018." . Issue v: We should seek written confirmation from the landowner	*[Not addressed in 'Response to Further information request – 55 Fitzroy Park']*	Further action requested	Issue v: We met on Bob Warnock of the City of London (and his then Hydrology advisor) on 1st May 2018 (not 10th May) and discussed how best to deal with the water that runs across Millfield Lane. I think we mistakenly understood at the time that the CoL were indicating a preference that they wished to see it removed and dealt with by means of a pipe installed under the carriageway of the lane. On 4th October 2018 we re-iterated to the CoL that we had no strong feelings on the matter but wished to accommodate whichever of the following options the CoL felt to be the most appropriate.1) Leave as is 2) Replace with a pipe or 3) Replace with a more formal surface stone/concrete "ford/channel". Unfortunately, the CoL were unable to provide any clarification but have since indicated that they have commissioned an independent hydrological consultant. On 26th October 2018 the CoL wrote that they would not support a request to discharge water onto the Heath, but again were unable to clarify what they wished to happen with the existing discharge. However, it would seem somewhat unlikely that the historic discharge of an ancient watercourse would require CoL permission to flow. (Not the least because the flow must be seen as an important contribution to the wetland area of the nature reserve, and, ultimately, to the Highgate Pond chain.)

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The reference states landscaping without providing further details. Issue vi: Final details may be conditioned, but we should ask for additional information to clarify the measures in outline.	*[Not addressed in 'Response to Further information request – 55 Fitzroy Park']*	Further action requested	Issue vi: The landscaping details will be finalised in due course to provide the flood defence required. The required measures were outlined in the Hydrological & Hydrogeological assessment LBH4480 Ver 2.0 section 7.8 (page 31), where it was indicated that local landscaping would be used to direct any surface water flooding away from Plots 4& 5 and direct this to the designated overland flood route immediately to the north of Plot 5. (see attached additional information in the form of a plan and sketch sections by Coyle Kennedy)

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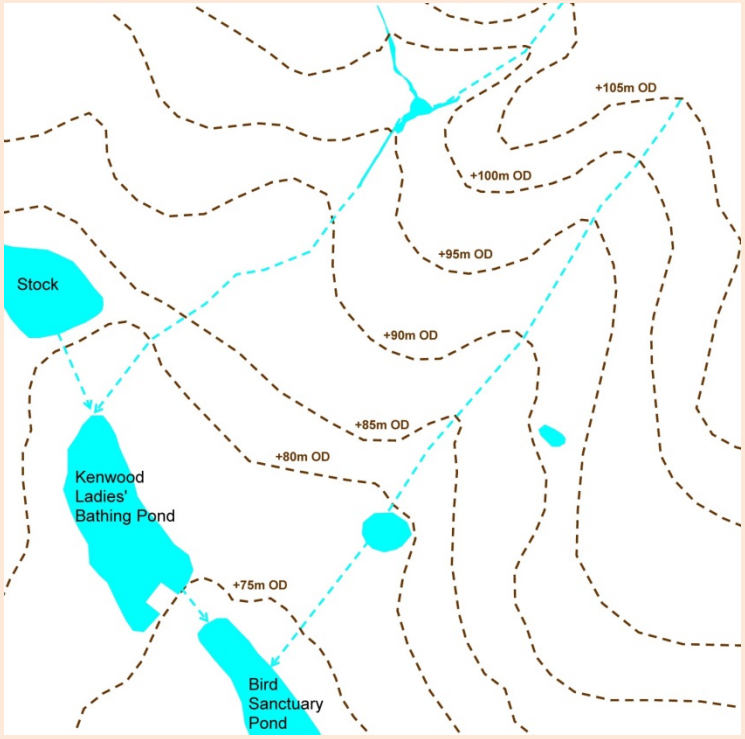
ISSUE REF:	LLFA 4TH COMMENTS 15/01/2020	APPLICANT RESPONSE 11/02/2020
Issue 1: **(SuDS)**	Comment: - The information within the *Response to Further Information request* indicates the total storage volume of the swales, the attenuation tank and the green and blue roof to be 141m^3. - The *Drainage Report* indicates the drainage strategy for the development will comprise of discharging runoff from the "*paved carparking & roads areas & discharging to the combined sewer running beneath Fitzroy Park via attenuation*". The drainage plan (*Drawing No. P300 Rev B*) shows a 3m^3 attenuation tank connecting to *MH S5*. The Asset MH S5 is a Hydro-brake flow control manhole restricting flows to 5l/s. It is assumed the attenuation tank is designed as offline storage for this section of the drainage network as the drainage plan shows no online connections draining to the tank. The storage provided by this attenuation tank is not mentioned in the proposed attenuation storage stated in the *Response to Further Information request*. - The *Drainage Report* also indicates the drainage strategy for the *"blue/green roofs, paved areas & footpaths*" will discharge "*through the attenuation / swale via percolation*". An overflow pipe is proposed to discharge excess flows from the attenuation to the Heath. - Furthermore, the Figure (no label) in the *Addendum to BIA Submission* report shows the location proposed for infiltration to be underlain by London clay which lies at approximately 80.5 mAOD. The ground level shown in the Figure indicates the ground level to be 81.2 mAOD. The report presents groundwater monitoring results from September 2017 and November 2018 investigations. The highest groundwater level, with respect to ground level, were record 80.14 mAOD	The LLFA comments of 15th January do not reflect what was presented and discussed at the meeting of 26th November. It is necessary to right back to the initial hydrological & hydrogeological impact assessment report and to understand that this site substantially comprises a parcel of land with a watercourse running through it. Over the ages, that watercourse has become largely hidden but it is still there, feeding the pond and in turn the Heath Nature Reserve and the Bird Sanctuary.  It has been recognised from the very outset of the project that the potential

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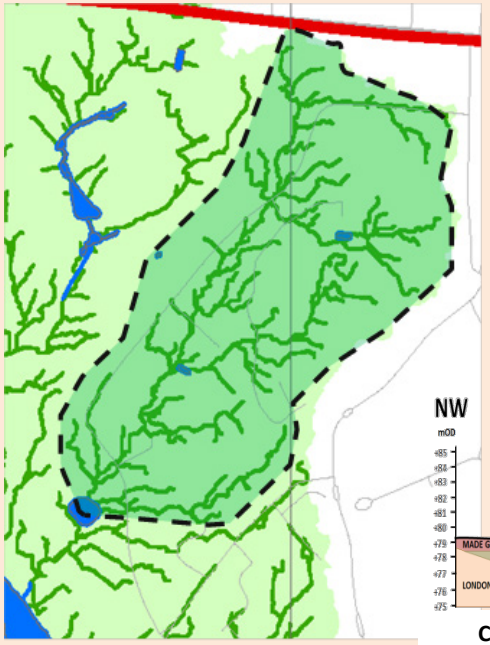
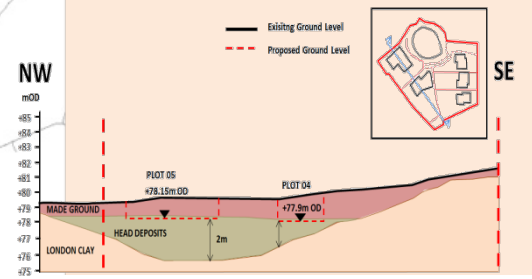
	in September 2017 and 80.05 mAOD in November 2018. These values are equivalent to 0.66m below ground level (bgl) and 0.75m bgl respectively. If infiltration is feasible, it would not be compliant with guidance within the SuDS Manual. - The borehole records for BH2, found in the *Site Investigation Report,* show Clay was encountered up to a depth of 30m. - No infiltration rates and calculations for the infiltrations SuDS are provided in the information submitted, therefore it is not possible to assess the SuDS against the design standard (i.e. the 1 in 100 year plus Climate Change event). - The drainage layouts (*Drawing No. P-300 Rev B and Drawing No. P-301 Rev A*) indicate that the swales lie outside the site boundary. - The drainage network sections plan (*Drawing No. P-302)* indicates the invert level (IL) of the foul network at the outfall to the combined sewer to be 82.101 m AOD and the IL of the surface water network at the outfall to combined sewer network to be 81.145 m AOD. However, the IL of the existing Thames Water sewer has not been provided. Thames Water asset plans are provided in the *Addendum to BIA Submission* report, however the asset information for the proposed connection point is not within the asset search boundary. - The drainage strategy indicates that the foul will discharge from the site by pumping. ***Action for applicant:*** ***Provide evidence to demonstrate infiltration is the most***	impacts of development could affect not only the development itself, but also neighbouring properties and the wider neighbourhood, including the important wildlife habitats of the Hampstead Heath nature reserve and more specifically the Highgate Ponds, which lie a short distance below the site. It is not a matter of requesting permission from the CoL for the watercourse to be allowed to continue to discharge into the nature reserve. Conversely, it is absolutely essential that it should continue to do so.  Pond Catchment Area (based upon Lidar) There is an obvious mismatch between the assessed run-off for this sizeable catchment area and the observed volume of flow (<1litre/sec) seen trickling across Millfield Lane from the pond outfall. The answer lies in the detailed geology that has been established as below.  Cross section across buried valley feature The SuDS statement acknowledged the presence of perched groundwater

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	appropriate method of discharge from the site as the evidence found in the ground investigation report indicates that infiltration is not viable due to geology and the high water table. ***Provide evidence that the swale location is permitted by the landowner. Furthermore, provide evidence that the swale attenuation volume is correct considering groundwater levels in this area.*** ***Provide the invert level of the existing Thames Water combined sewer which the outfalls from the proposed site drainage will connect to.***	running through the made ground along the upper surface of the London Clay as evidence of some permeability within the overlying soils. The purpose of SuDs is to restore the natural balance and to prevent negative impacts. The pattern of natural drainage at this site has to be understood and preserved in order to ensure that the nature reserve still receives all the water that it previously did, subject to attenuation to remove any increased flood risk resulting from a faster and increased discharge from the developed areas of the site. The proposed Millfield Lane swale is located entirely within the site ownership but has been located outside the plot boundaries at the request of the CoL for ease of maintenance. The attenuation volume has been previously demonstrated and the nature of the overflow will be a matter following advice from the CoL on whether they wish to continue to see water running over Mill Lane, or require it to be culverted beneath the carriageway. The existing foul water drainage discharge invert level is recorded at +81.62m OD
Issue 2: **(Calcs)**	Comment: The preferred method of discharge from the swale / attenuation tank is via infiltration. However, no (infiltration) calculations are provided to demonstrate the hydraulic performance of the infiltration SuDS against the required design standard (i.e. 1 in 100 year plus 40% CC). Further, an overflow pipe is proposed from the attenuation tank but no calculations have been provided to show the likely discharge rate from the attenuation SuDS when the capacity has been exceeded.	Calculations have been provided to demonstrate that the capacity of the attenuation that will be provided for the development has been calculated on the basis of what is required to deliver the site run-off at a greenfield rate for the 1 in 100 year plus 40% CC design standard. However, the reader must understand that this is not any new discharge. This is water that is currently entering the downstream nature reserve by a combination of percolation beneath the carriageway of mill lane and by running across it. Calculations have been provided. The SuDS scheme has been carefully designed to accommodate and preserve existing infiltration and percolation

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	Action for applicant: ***Applicant to provide infiltration rates and supporting calculations for the infiltration SuDS to verify the hydraulic performance of the infiltration SuDS.*** ***Additionally, calculations in demonstration of the discharge rates from the swale / attenuation tank for the 1 in 100 year plus Climate Change event should be provided.***	beneath the Mill Lane carriageway into the nature reserve while not relying upon this for effectiveness. The CoL have suggested that some testing and monitoring of the swale itself during initial construction might be considered to inform the final overflow design.
Issue 3: **(Heath)**	Comment: The correspondence from Nexus Planning, dated 21 October 2019, confirms that the City of London Corporation has <u>not</u> given permission for overflows from the proposed development to be discharged to the Hampstead Heath. In addition, the letter from Kenwood Ladies Pond Association also expresses concerns about the proposed development in terms of the long-term impact of the drainage strategy on the surrounding environment. ***Action for applicant:*** ***Consent has not been granted by the City of London Corporation to discharge overflows from the infiltration SuDS to the Hampstead Heath. An alternative solution following the drainage hierarchy should be sought.***	We confirm that permission is <u>not</u> required to preserve the existing watercourse. The suggestion that “an alternative solution should be sought” implies a worrying lack of understanding. We have repeatedly stressed that that the most important issue here is to preserve the natural drainage situation. Is the LLFA is seriously advising stopping up of the watercourse and its diversion to some receptor other than the nature reserve? This would be frankly unthinkable and could lead to fairly disastrous environmental consequences for the existing wetland area and would doubtless also affect the Highgate Ponds beyond.
Issue	Comment:	This issue was addressed and closed out on 11/12/2019. It is apparent that

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4: **(Flood)**	The Extract from Hydrological and Hydrogeological Impact Assessment indicates it is planned to provide raised landscaping around Plot 4 and 5 to direct surface water floodwater away from the buildings and direct it towards the pond. <u>Recommendation – Further information required</u>	the LLFA has possibly not seen all of the relevant information, including the full Hydrological and Hydrogeological assessment that we have referred to above.

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ISSUE REF:	LLFA 5TH COMMENTS (AECOM) 10/03/2020	**APPLICANT RESPONSE** **14/08/2020**
Issue 1: **(SuDS)**	Comment: There is no demonstration in the MicroDrainage calculations or the drawings of how the discharge will be restricted. The concept of infiltration with overflow to the Heath is not supported by infiltration testing in accordance with BRE 365 or orifice sizing in the MicroDrainage calculations. Furthermore, evidence suggests groundwater levels are too high to allow the recommended 1m between base of infiltration measure and top of water table to ensure infiltration feature does not fill with groundwater and to assist with the removal of pollutants through the action of percolation. Volumes provided in pro-forma, report and drawing do not correspond with each other, so it is difficult to decipher what is being proposed. In principle, the surface water runoff arising from the site should be less than the existing, as the total impermeable area is less than that existing according to the pro-forma. However, surface water runoff arising from the existing dwelling appears to discharge to the combined sewer, and therefore surface water runoff arising from hard standing areas across the proposed development should discharge to the combined sewer, unless infiltration is proven to be feasible on this site.	The discharge of the surface water run-off into the infiltration trench from the attenuation tank will be restricted by an orifice flow control. It is noted that BRE 365 soakage testing would not be technically appropriate for a largely submerged infiltration trench.This comment appears to have stemmed from a misconception that soakaways were being considered installed. The infiltration trench is expected to be full of water and to spill a constant trickle of water across the Millfield Lane carriageway as at present. No potentially polluted water will be permitted to discharge into the SuDS. However, it is anticipated that selected wetland planting can be used within the roadside infiltration trench to “clean” the water to some extent, capturing pollutants before they enter the heath. The pro-forma, drainage report and drawings have now been aligned. No. Only some of the surface water run-off is led to the sewer and it would be a tragedy if all the impermeable areas were directed in future to the sewer. We have carefully separated out that drainage that poses a potential pollution threat, such as that from car parking areas, from that coming from green/blue roof areas and gardens.

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ISSUE REF:	LLFA 5TH COMMENTS (AECOM) 10/03/2020	**APPLICANT RESPONSE** **14/08/2020**
	The gully connecting to pipe S3.003 should connect into S2.000 due to this area being a designated parking space. The angle between pipe S1.002 and S1.003 needs revising to ensure no acute connections.	The drawing has been revised. Note these are outline rather than detailed design drawings at this stage, purely to demonstrate the feasibility of what is intended.
	It is stated that permission is not required to preserve the existing watercourse. However, in the Hydrological & Hydrogeological Impact Assessment report (Document reference LBH4480 V2.0) report it is stated that 'What is left of the valley feature does not appear to contain any permanent water course, but parts of it are evidently swampy and it is presumed to be liable to some intermittent flooding during storm events'. Evidence would need to be provided to demonstrate the existence of a culvert or other drainage conduit carrying water towards the Heath that could be defined as a 'watercourse'.	The presence of the watercourse is not disputed. It has been well-documented even in this tracker. This is an EA map confirming the line of the course down which water flows under gravity through the site. 
	The main source of pollution from this site are from vehicles, which will be managed through the installation of a separate drainage system, and during construction. There is also a risk of polluted runoff entering the Heath via overland flows as there is a surface water flood flow pathway crossing the site. Any pollutants transported by this pathway would arise from this specific pathway's catchment, not just from the site.	This may be a comment rather than a query. All these risks have been addressed in the Hydrological & Hydrogeological Impact Assessment report.
	The location of the land drain adjacent to plots 1-3 may need to be removed. This area is already served by positive drainage to ensure all pollutants are intercepted, introducing a land drain here potentially creates a pollution pathway.	No. This is a misunderstanding. The land drain is necessary in order for the proposed Plots 1-3 not to create any obstruction to groundwater. As does seem to be understood, all surface runoff from the road will not be allowed to infiltrate below the pavement, instead being routed to gullies and directed towards the dedicated surface water drainage leading to a sewer discharge so as not to threaten the heath as at present.

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ISSUE REF:	LLFA 5TH COMMENTS (AECOM) 10/03/2020	**APPLICANT RESPONSE** **14/08/2020**
	Comment: The proposed basements will obstruct groundwater flows. The mitigation offered could be feasible and is adequate at an outline design stage. Designs will need to be progressed to understand how they will be maintained and what happens if they silt up/fail. Evidence needed to progress detailed design includes information of groundwater levels at each plot, how groundwater will be routed around foundations and basements, understanding of groundwater flow rates, sizing of stone filled mitigation trenches, freeboard needed to avoid flooding of habitable space and design measures to ensure stone isn't "washed away" by groundwater movement. Groundwater flows routes will be impacted by the development of this site, but perforated land drains are proposed to mitigate this and keep the general route of groundwater flow similar to existing. As per previous comments, these land drains should be sized according to the measured groundwater flows.	This is accepted – it is understood the level of information presently provided is satisfactory to the LLFA and that the detailed design of the land drains will be progressed following planning approval.
Issue 2: **(Calcs)**	Comment: The surface water pipe network model uses a 1 in 5 year event, and it is only this return period that is presented in the MicroDrainage calculation output. Results for a variety of return periods and evidence that the proposed attenuation volume is appropriate have not been provided. The proposed attenuation is sized to accommodate the 1 in 100 year + climate change event, with discharge restricted to Qbar, but the MicroDrainage calculations do not demonstrate this, and the drawing does not show how discharge will be restricted to this	Coyle Kennedy advise that there is no requirement to design pipe works for return periods of more than 1 in 5 year events. Results for a variety of return periods and evidence that the proposed attenuation volume is appropriate have been provided. This attenuation analysis is demonstrated in detail in the Suds Pro-forma and calculations. See above. The sewer discharge will be controlled by an orifice.

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ISSUE REF:	LLFA 5TH COMMENTS (AECOM) 10/03/2020	**APPLICANT RESPONSE** **14/08/2020**
	rate. Foul sewer MicroDrainage network design shows pipe gradients need revising as self-cleansing velocity is not being achieved outside of pipe full conditions. If gradients cannot be made steeper, 150mm diameter pipe should be tested in the MicroDrainage model to try and achieve the required velocity.	Coyle Kennedy advise that the falls in the foul water pipes are in accordance with the building regulations for individual houses.
Issue 5: **(Foul)**	Comment: Existing foul sewer crossing the site will be intercepted and accommodated by the on-site pumping station. What flows are expected? Have flows been monitored or have you estimated expected flows? What happens to the now redundant existing pipe? Do you know if there are further connections downstream? Can access for maintenance be guaranteed? Who will maintain it, as there is a risk that Thames Water won't adopt it and therefore sewerage from beyond the boundary of 55 Fitzroy Park will be the responsibility of a private owner. The foul drainage proposed for the site is reasonable, providing the new pumping station can be accessed. Being responsible for foul flows from beyond the site boundary is a risk and it would be strongly recommended to seek Thames Water adopt these assets. Has pre-application advice been sought from Thames Water on the proposed flows discharging to the combined sewer?	Coyle Kennedy advise that the anticipated flows will not exceed 0.20 l/s. Flows have been monitored. The pipe will be capped of as per good practice. No. The CCTV survey has reported that there are not further connections downstream. Yes. Access will be maintained. Thames water do not need to be engaged at present. The granting of planning permission is not dependant upon adoption of the drainage assets.

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ISSUE REF:	LLFA 6TH COMMENTS 03/06/2020	APPLICANT RESPONSE 14/08/2020
Issue 1:	Comments: - State the assumed infiltration rate used to size the infiltration features and provide at least one representative infiltration rate test, given the fundamental impact on the entire drainage and hydrology strategy. - Outline the existing and proposed runoff volumes (to demonstrate that there will be no extra volume of water entering the Heath compared to existing). - Demonstrate that the proposed below ground attenuation features are sufficiently above the groundwater levels or have been designed so storage will not be taken up by groundwater rather than surface runoff.	It is not possible to undertake meaningful testing of the soils beneath Millfield Lane at this stage. As a first approximation of the inferred average ground permeability beneath Millfield Lane an assessment of the average catchment rainfall can be applied to the assessed cross-sectional area of permeable fill / head beneath the road embankment. Catchment = 125,000 square metres Average rainfall = 625mm CSA permeable = 90 square metres Inferred permeability = 2 x10^{-5} m/sec The final sizing of the wet swale/infiltration trench and the design any overspill system will be undertaken following trials of an initial trench during the initial construction works on site. The intention of the design is to preserve the status quo and that there is to be no lesser and no extra volume of water entering the Heath compared to the existing. However, as a result of the attenuation being provided, shorter period storms will no longer lead to immediate flooding of Millfield Lane. The location of the attenuation is shown in section in the drainage report, demonstrating that is clear of the groundwater.

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ISSUE REF:	LLFA 6TH COMMENTS 03/06/2020	APPLICANT RESPONSE 14/08/2020
Issue 2:	- Provide an updated drainage layout plan clearly demonstrating how the drainage will operate, including pipe sizes and gradients and volumes which correspond with supporting calculations, along with the changes discussed (removal of pipe under Millfield Lane; renaming the 'swale'; increase distance between infiltration trench and lane) -	An updated drainage layout is contained within the updated drainage report by Coyle Kennedy
Issue 3:	- Provide most recent correspondence with Thames Water regarding acceptance of the proposed new pump chamber	Thames Water will be approached following planning approval. The proposed drainage system is not dependent upon adoption by Thames Water.
Issue 4:	- Submit further proposed details for management of flood risk during construction, including measures to avoid offsite runoff and contamination (to be reflected in updated CMP)	These further details will be a matter for the CMP, which is a live document and subject to scrutiny and approval. In this case the contractors will provide their detailed proposals for management of the risks initially to the design team for scrutiny and approval and then subsequently to Camden via the CMP. In addition to the avoidance of run-off there is a need minimise the presence of liquid hydrocarbon fuels and other potentially harmful substances on site and to maximise pre-fabrication of completed elements..

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ISSUE REF:	LLFA ISSUE REF:	LLFA 7TH COMMENTS 27/11/2020	APPLICANT RESPONSE 04/02/2021
Issue (SuDs)	1)	State the assumed infiltration rate used to size the infiltration features and provide at least one representative infiltration rate test, given the fundamental impact on the entire drainage and hydrology strategy. **Partially Provided.** **Comments:** The LLFA Drainage Comment Tracker indicates no soakage test in accordance with BRE Digest 365 has been undertaken and mentions "soakage testing would not be technically appropriate for a largely submerged infiltration trench". The LLFA Drainage Comment Tracker also mentions "the infiltration trench is expected to be full of water and to spill a constant trickle of water across the Millfield Lane carriageway as at present". The Site Drainage Layout (Drawing No. P300 Rec D) indicates surface water will discharge at 5 l/s to the infiltration trench and when the capacity of the trench is exceeded overflows will be directed to an offline attenuation tank. The LLFA Drainage Comment Tracker provides an approximate infiltration rate of 2 x 10-5 m/s based on assumptions of the permeability beneath Millfield Lane and indicates "the final sizing of the wet swale/infiltration trench and the design any overspill system will be undertaken following trials of an initial trench during the initial construction works on site". Therefore, the design standard of the infiltration trench is not confirmed based on actual site conditions. **Action for applicant:** **Provide results of site investigations to determine the infiltration rate and update the drainage strategy accordingly.**	A re-infiltration test report was issued on 4/2/2021, suggesting a k value of 1.7 x10^{-5} m/sec. This figure, although very approximate, compares well with the previously assumed figure of 2.0 x 10^{-5} m/sec and hence no update of the drainage strategy is required.
	2)	Provide an updated drainage layout plan clearly demonstrating how the drainage will operate, including pipe sizes and gradients and volumes which correspond with supporting calculations, along with	

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		the changes discussed (removal of pipe under Millfield Lane; renaming the 'swale'; increase distance between infiltration trench and lane). **Partially Provided.** **Comments:** The Site Drainage Layout (*Drawing No. P300 Rec D*) in Appendix A of the Drainage Report sets out layout of the proposed drainage arrangement. The Drainage Report mentions that runoff off from the paved areas and the car parks will be discharged to the combined sewer via a Petrol Interceptor, and runoff from the blue/green roofs, paved areas and footpaths will be discharged via "*attenuation/infiltration trench via percolation*". <u>Drainage system for the blue/green roofs, paved areas and footpaths</u> The cover levels and manhole depths are indicated on the Site Drainage Layout, and the invert levels of the surface water manholes are shown on the Drainage Network Sections plan (Drawing No. 302 Rev A). The asset information for the blue/green roofs, paved areas and footpaths drainage system indicates surface water runoff is conveyed directly to the infiltration trench, and also overflows from the pond are also conveyed to the infiltration trench. The pond is an existing drainage feature at the site, and the capacity of the infiltration trench is not labelled on the Site Drainage Layout. Surface water runoff is then discharged to the infiltration trench at 5l/s via a flow control device; and when the capacity of the trench is exceeded, overflows from the infiltration trench are conveyed to the attenuation tank. The cover level (i.e. 77.9m), the invert level (i.e. 77.5m) and the capacity of the tank (i.e. 35m3) are shown on the Site Drainage Layout; however, the asset information for the flow control device and the inspection chamber upstream of the flow control device is not provided. The total attenuation provided by the green roofs is not labelled on	

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		the Site Drainage Layout, however the total attenuation provided at each plot is summarised in Appendix B of the Drainage Report. A total of 125.7m^3 of blue and green roof attenuation is proposed at the site. Additionally, no asset information has been provided for the blue/green roofs. The drainage strategy proposes to locate the infiltration trench immediately adjacent to Millfield Lane. Building Regulations (Part h) states that "*infiltration devices should not be built within 5m of a building or road or in areas of unstable land*". The infiltration trench does not meet this requirement. <u>Drainage system for paved areas and the car parks</u>. The cover levels and depths of the manholes for the drainage system for the paved areas and the car parks is shown on the Site Drainage Layout, and the invert level of the surface water manholes are provided on the Drainage Network Sections drawing. The proposed discharge rate for the surface water drainage is 5 l/s, and offline an attenuation tank of capacity 3m^3 is provided upstream of the flow control device. The Drainage Network Sections drawing indicate the surface water drainage will connect to the combined manhole at invert – 81.145m and the foul network will connect to the combined manhole at invert – 82.101m. A review of the invert levels on the Drainage Network Sections for manholes S12 (i.e. 79.219m) and S13 (78.419m) indicates the foul sewer rising main which rises downstream of manhole F6 (i.e. 76.784m) is shown to clash with the blue/green roofs, paved areas and footpaths drainage system which discharges via infiltration. There is no information in the Drainage Report to demonstrate how cross contamination will be prevented.	

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		Action for applicant: ***Provide an updated drainage layout plan with details of the capacity of the green/blue roofs.*** ***Provide robust justification as to why the infiltration trench is not in compliance with Building Regulations.*** ***Demonstrate how cross contamination between the surface water drainage and the foul network will be prevented.***	To be provided by Condition as part of the detailed design. Nothing will be provided that is not in compliance with the Building Regulations This is being achieved by using different pipework systems (in the usual fashion).
	3)	Outline the existing and proposed runoff volumes (to demonstrate that there will be no extra volume of water entering the Heath compared to existing). **Provided.** **Comment:** Calculations to demonstrate the existing and proposed runoff rates and volumes are provided in SuDS Run-off calcs (*ref: 4599*) and they demonstrate the '*Proposed Exceedance of Greenfield Run-off Volumes'* (ref: Sheet 5 of 8) to be less than the '*Existing Exceedance of Greenfield Runoff Volumes'* (ref: Sheet 4 of 8). The calculations also demonstrate the total attenuation required on Sheet 6 of 8, and Sheet 7 of 8, which indicate that approximately 160.7m^3 of attenuation is required to achieve Greenfield runoff rate for the 1 in 100 year plus 40% climate change event; and Appendix B of the Drainage Report indicates this has been provided by the green/blue roofs and surface water attenuation.	Issue Closed

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	4)	Demonstrate that the proposed below ground attenuation features are sufficiently above the groundwater levels or have been designed so storage will not be taken up by groundwater rather than surface runoff. **Partially Provided.** **Comments:** LLFA Comments dated 15th January 2020 identified that "*the ground level shown in the Figure indicates the ground level to be 81.2 mAOD. The report presents groundwater monitoring results from September 2017 and November 2018 investigations. The highest groundwater level, with respect to ground level, were record 80.14 mAOD on September 2017 and 80.05 mAOD in November 2018. These values are equivalent to 0.66m below ground level (bgl) and 0.75m bgl respectively.* The Site Drainage Layout (*Drawing No. P300 Rec D*) in Appendix A of the Drainage Report indicates the invert level of the attenuation tank to be 77.5m. Hence, there is the potential for groundwater ingress to the attenuation storage if suitable mitigation is not implemented. ***Action for applicant:*** ***Provide details of how the surface water attenuation will be designed to prevent storage being taken up by groundwater during periods of high groundwater levels on the site.***	The location of the attenuation is shown in section in the drainage report, demonstrating that is clear of the groundwater. It is noted that Aecom misinterpreted the groundwater monitoring data and referred to data from Boreholes 6 & 7 from higher up the hill. The highest groundwater level recorded in the area of the attenuation tank is +77.3 mAOD, 200mm below the tank invert.
Issue (Foul)	5)	Has pre-application advice been sought from Thames Water on the proposed flows discharging to the combined sewer. **Not Provided.** **Comment:** The proposed surface water drainage discharges to the combined sewer along with the foul network, and consultation with Thames	

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		Water is required to determine if the existing sewer has sufficient capacity to accept combined flows from the new development or whether infrastructure upgrades would be required. Furthermore, Thames Water should be in agreement with the proposed discharge rates and the proposed connection point to the combined sewer. ***Action for applicant:*** ***Provide written confirmation from Thames Water that there is sufficient capacity existing in the network, and the proposed point of discharge and discharge rate are acceptable.***	To be provided by Condition as part of the detailed design. Thames Water will be approached following planning approval in the usual manner.
	6)	Can access for maintenance be guaranteed? Who will maintain it, as there is a risk that Thames Water won't adopt it and therefore sewerage from beyond the boundary of 55 Fitzroy Park will be the responsibility of a private owner? **Not Provided.** **Comment:** The LLFA Drainage Comment Tracker states "*access will be maintained*" but does not provide a maintenance plan for the new pump chamber or indicate who will be responsible for ensuring the pump chamber is maintained. ***Action for applicant:*** ***Provide details of the management and maintenance for the new pump chamber with details of how it will be secured for the lifetime of the development and who will be responsible for ensuring it is maintained.***	To be provided by Condition as part of the detailed design.
	7)	Provide most recent correspondence with Thames Water regarding acceptance of the proposed new pump chamber. **Not Provided.** **Comment:**	

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		The LLFA Drainage Comment /Query Tracker indicates "Thames Water will be approached following planning approval. The proposed drainage system is not dependent upon adoption by Thames Water". ***Action for applicant:*** ***Provide correspondence from Thames Water regarding acceptance of the proposed new pump chamber.***	To be provided by Condition as part of the detailed design. Thames Water will be approached following planning approval in the usual manner.
Issue (CMP)	8)	Submit further proposed details for management of flood risk during construction, including measures to avoid offsite runoff and contamination (to be reflected in updated CMP). **Not Provided**. **Comment:** The LLFA Drainage Comment Tracker indicates "*the contractors will provide their detailed proposals for management of the risks initially to the design team for scrutiny and approval and then subsequently to Camden via the CMP*". It is assumed this document will be provided at detailed design or prior to the commencement of construction. The LLFA Drainage Comment Tracker also states the "need minimise the presence of liquid hydrocarbon fuels and other potentially harmful substances on site and to maximise pre-fabrication of completed elements". It is also assumed this will be addressed in the CMP. ***Action for applicant:*** ***Provide details for management of flood risk during construction, including measures to avoid offsite runoff and contamination (to be reflected in an updated CMP).***	These further details will be a matter for the CMP, which is a live document and subject to scrutiny and approval. In this case the contractors will provide their detailed proposals for management of the risks initially to the design team for scrutiny and approval and then subsequently to Camden via the CMP. In addition to the avoidance of run-off there is a need minimise the presence of liquid hydrocarbon fuels and other potentially harmful substances on site and to maximise pre-fabrication of completed elements..

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Issue (SuDs)	a)	**Runoff Destination (at site boundary)** **More information required** Following an updated infiltration rate provided by the applicant. Demonstrating that infiltration is possible on site. The applicant has not made it clear within the, 'Addendum Surface Water Drainage Statement - LBH4480suds Ver. 1.1 December 2018'. What areas of site will be managed specifically by infiltration and what areas of site will be managed via attenuation and discharging back to the sewer at a controlled rate. Also clarity is needed on what infiltration techniques will be used. The applicant has not provided an updated drainage strategy showing the locations of all drainage SuDS features and pipes and if runoff from different areas will be managed by attenuation or infiltration.	It is apparent from this comment that Metis have not been provided with the engineer's drainage report that contains this detail. This issue has been previously closed. A final version of the SuDs chain and drainage system is to be provided by condition following the detailed design.
	b)	**Flood Risk Outside of Development** Following previous comments provided within the 'LLFA comments_2018.3672.P_021220'. The last set of information requested did not require further comment on this parameter.	Issue Closed
	c)	**Peak Flow Control** Following previous comments provided within the 'LLFA comments_2018.3672.P_021220'. The last set of information requested did not require further comment on this parameter.	This issue has been previously closed. A final version of the calculations is to be provided by condition as part of the detailed design.

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		However, information provided shows inconsistencies between the latest SuDS Proforma and previous information provided and no calculation supporting these values have been submitted.	It is apparent from this comment that Metis have been trying to compare to initial calculations from July 2018 that were subsequently modified in response to increasing levels of detail being request over the period 2018 to 2020. Supporting calculations were provided at each stage. .
	d)	**Volume Control** Following previous comments provided within the 'LLFA comments_2018.3672.P_021220'. The last set of information requested did not require further comment on this parameter.	Issue Closed
	e)	**Flood Risk** Following previous comments provided within the 'LLFA comments_2018.3672.P_021220'. The last set of information requested did not require further comment on this parameter	Issue Closed
	f)	**Maintenance** Following previous comments provided within the 'LLFA comments_2018.3672.P_021220'. The last set of information requested did not require further comment on this parameter.	Issue Closed

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	g)	**Any other matters?** Following previous comments provided within the 'LLFA comments_2018.3672.P_021220'. The last set of information requested did not require further comment on this parameter.	Issue Closed
	1.	The applicant has demonstrated within 'Infiltration test report (LBH4480i Ver. 1.0) that infiltration can be achieved on site. However clarity is needed to demonstrate what areas of the site will be managed using infiltration methods and which areas will be attenuated and discharged from the site at a controlled rate of up to 7.08l/s. As required in line with the previous response dated 27/11/2020 within, 'LLFA comments_2018.3672.P_021220'. Specifically stating, 'Provide results of site investigations to determine the infiltration rate and update the drainage strategy accordingly.' **To address the above, please can the applicant submit information which:** Shows an updated drainage strategy in line with the updated infiltration rate provided to clearly demonstrate the strategy for managing surface water on site. The strategy should also include a plan showing the layout and location all drainage features including SuDS, pipes and discharge points and rates from the site.	It is apparent from this comment that Metis have not been provided with the engineer's drainage report that contains this detail. This issue has been previously closed. A final version of the SuDs chain and drainage system is to be provided by condition following the detailed design.
	2.	The applicant has provided an updated SuDS proforma which differs from previous information given within 'Addendum Surface Water Drainage Statement' in terms of runoff rates proposed from the site.	

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		To address the above, please can the applicant submit information which: Clarifies the runoff rate for areas of the site proposing to discharge offsite. Confirming the correct rates and providing calculations to demonstrate in line with Non-statutory technical standards for SuDs and the London Plan Policy SI 13.	It is apparent that Metis have been trying to compare to initial calculations from July and December 2018 that were subsequently modified in response to increasing levels of detail being request over the period 2018 to 2020. Supporting calculations were provided at each stage.
		Note to LLFA: Following a review of the previous recommendations made by Aecom, we would recommend that where possible a number of the points are addressed prior to conditioning. Specifically point 1-7 and 10 below (taken from Aecom recommendations for conditioning within 'LLFA comments_2018.3672.P_021220' : 1. Provide an updated drainage layout plan with details of the capacity of the green/blue roofs. 2. Engineering plans should be updated accordingly along with supporting surface water calculations provided for each of the SuDS and critical drainage elements, including the flow control features. 3. Provide calculations to demonstrate the hydraulic performance of the entire SuDS network, including the proposed pipe network, for the 1 in 1 year, 1 in 30 year, 1 in 100 year and 1 in 100 year plus 40% climate change.	1. Details were provided in the Coyle Kennedy Drainage Report. Further details are to be provided by Condition as part of the detailed design. 3. Hydraulic calculations were provided in the Coyle Kennedy Drainage Report. Further details are to be provided by Condition as part of the detailed design.

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		4. Provide robust justification as to why the infiltration trench is not in compliance with Building Regulations . 5. Demonstrate how cross contamination between the surface water drainage and the foul network will be prevented. 6. Provide details of how the surface water attenuation will be designed to prevent storage being taken up by groundwater during periods of high groundwater levels on the site. 7. Provide written confirmation from Thames Water that there is sufficient capacity existing in the network, and the proposed point of discharge and discharge rate are acceptable. 8. Provide evidence to demonstrate that the City of London Corporation have no objections to the detailed design of the drainage system. 9. Provide details of the management and maintenance for the new pump chamber with details of how it will be secured for the lifetime of the development and who will be responsible for ensuring it is maintained.	4. Nothing will be provided that is not in compliance with the Building Regulations. 5. This is being achieved by using different pipework systems (in the usual fashion). 6. The location of the attenuation is shown in section in the drainage report, demonstrating that is clear of the groundwater. It is noted that Aecom misinterpreted the groundwater monitoring data and referred to data from Boreholes 6 & 7 from higher up the hill. The highest groundwater level recorded in the area of the attenuation tank is +77.3 mAOD, 200mm below the tank invert. 7. To be provided by Condition as part of the detailed design. Thames Water will be approached following planning approval in the usual manner. 9. To be provided by Condition following the detailed design.

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		10. Provide correspondence from Thames Water regarding acceptance of the proposed new pump chamber.	10. To be provided by Condition as part of the detailed design. Thames Water will be approached following planning approval in the usual manner.
		11. Provide details for management of flood risk during construction, including measures to avoid offsite runoff and contamination (to be reflected in an updated CMP).	11. These further details will be a matter for the CMP, which is a live document and subject to scrutiny and approval. In this case the contractors will provide their detailed proposals for management of the risks initially to the design team for scrutiny and approval and then subsequently to Camden via the CMP. In addition to the avoidance of run-off there is a need minimise the presence of liquid hydrocarbon fuels and other potentially harmful substances on site and to maximise pre-fabrication of completed elements.