Appendix A Check List for NPPF Guidance on Flood Risk[4]

1 Development description and location
1a. What type of development is proposed and where will it be located? • A location plan at an appropriate scale should be provided with the FRA, or cross referenced to the main application when it is submitted.
Section 2.1
1b. What is its vulnerability classification? • Vulnerability classifications are provided in Table 2, NPPF Technical Guide
Section 2.1
1c. Is the proposed development consistent with the Local Development Documents?
Section 2.3
1d. Please provide evidence that the Sequential Test or Exception Test has been applied in the selection of this site for this development type? • Evidence is required that the Sequential Test has been used in allocating the proposed land use proposed for the site and that reference has been made to the relevant Strategic Flood Risk Assessment (SFRA) in selecting development type and design (See paragraphs 100-104, NPPF and paragraphs 3-5, NPPF Technical Guide). Your Local Planning Authority planning officer should be able to provide site-specific guidance on this issue. • Where use of the Exception Test is required, evidence should be provided that both elements of this test have been passed (see paragraphs 102, NPPF and paragraphs 4-5, NPPF Technical Guide). Your Local Planning Authority planning officer should be able to provide site-specific guidance on this issue.
Section 2.3
1e. *[Particularly relevant to minor developments (alterations & extensions) & changes of use]* Will your proposal increase overall the number of occupants and/or users of the building/land; or the nature or times of occupation or use, such that it may affect the degree of flood risk to these people?
2. Definition of the flood hazard
2a. What sources of flooding could affect the site? (see paragraph 2, NPPF Technical Guide). • This may include hazards such as the sea, reservoirs or canals, which are remote from the site itself, but which have the potential to affect flood risk (see Section 1 of the NPPF Practice Guide).
Section 3.4
2b. For each identified source, describe how flooding would occur, with reference to any historic records wherever these are available. • An appraisal of each identified source, the mechanisms that could lead to a flood occurring and the pathways that flood water would take to, and across, the site. • Inundation plans, and textural commentary, for historic flood events showing any information available on the mechanisms responsible for flooding, the depth to which the site was inundated, the velocity of the flood water, the routes taken by the flood water and the rate at which flooding occurred.
Section 3.4
2c. What are the existing surface water drainage arrangements for the site? • Details of any existing surface water management measures already in place, such as sewers and drains and their capacity.
Section 3.5
3. Probability
3a Which flood zone is the site within? • The flood zones are defined in Table 2, NPPF Technical Guide.
Sections 2.2

[4] http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/site-specific-flood-risk-assessment-checklist/

3b If there is a Strategic Flood Risk Assessment covering this site, what does it show? • The planning authority can advise on the existence and status of the SFRA.
Sections 2.3 & 3.4
3c What is the probability of the site flooding taking account of the contents of the SFRA and of any further site-specific assessment? This may need to include • a description of how any existing flood risk management measures affect the probability of a flood occurring at the site FRA Pro-forma • supporting evidence and calculations for the derivation of flood levels for events with a range of annual probability • inundation plans of, and cross sections through, the existing site showing flood extents and levels associated with events with a range of annual probability • a plan and description of any structures which may influence the probability of a flood occurring at the site. This may include bridges, pipes/ducts crossing a watercourse, culverts, screens, embankments or walls, overgrown or collapsing channels and their likelihood to choke with debris. • details of any modelling studies completed to define the exiting degree of flood risk
Section 3.6
3d What are the existing rates and volumes of run-off generated by the site? • This should generally be accompanied by calculations of run-off rates and volumes from the existing site for a range of annual probability events (see Section 21 of the NPPF Practice Guide).
Section 3.5
4. Climate change
How is flood risk at the site likely to be affected by climate change? • Paragraphs 11-15, of the NPPF Technical Guide provide guidance on how to assess the impacts of climate change.
Section 4.5
5. Detailed development proposals
Where appropriate, are you able to demonstrate how land uses most sensitive to flood damage have been placed in areas within the site that are at least risk of flooding, including providing details of the development layout? • Reference should be made to vulnerability classification, Table 2 of the NPPF Technical Guide. • Section 4 of the NPPF Practice Guide provide guidance on how the sequential approach can be used to inform the lay-out of new development sites.
Section 4.1
6. Flood risk management measures
How will the site be protected from flooding, including the potential impacts of climate change, over the development's lifetime? • This should show that the flood risk management hierarchy has been followed and that flood defences are a necessary solution. This should include details of any proposed flood defences, access/egress arrangements, site drainage systems (including what consideration has been given to the use of sustainable drainage systems) and how these will be accessed, inspected, operated and maintained over the lifetime of the development. This may need to include details of any modelling work undertaken in order to derive design flood levels for the development, taking into account the presence of any new infrastructure proposed.
Section 4.2

7. Off site impacts
7a How will you ensure that your proposed development and the measures to protect your site from flooding will not increase flood risk elsewhere? This should be over the lifetime of the development taking climate change into account. The assessment may need to include: • Details of the design basis for any mitigation measures (for example trash screens, compensatory flood storage works and measures to improve flood conveyance). A description of how the design quality of these measures will be assured and of how the access, operation, inspection and maintenance issues will be managed over the lifetime of the development. • Evidence that the mitigation measures will work, generally in the form of a hydrological and hydraulic modelling report. • An assessment of the potential impact of the development on the river, estuary or sea environment and fluvial/coastal geomorphology. A description of how any impacts will be mitigated and of the likely longer-term sustainability of the proposals.
Section 4.3
7b How will you prevent run-off from the completed development causing an impact elsewhere? • Evidence should be provided that drainage of the site will not result in an increase in the peak rate or in the volumes of run-off generated by the site prior to the development proceeding.
Section 4.3 & Appendix C
8. Residual risks
8a What flood-related risks will remain after you have implemented the measures to protect the site from flooding? • Guidance on residual risks is provided in Section 14 of the NPPF Practice Guide.
Section 4.4 & Appendix C
8b How, and by whom, will these risks be managed over the lifetime of the development? • Reference should be made to flood warning and evacuation procedures, where appropriate, and to likely above ground flow routes should sewers or other conveyance systems become blocked or overloaded. This may need to include a description of the potential economic, social and environmental consequences of a flood event occurring which exceeds the design standard of the flood risk management infrastructure proposed and of how the design has sought to minimize these – including an appraisal of health and safety issues.
Appendix C

Appendix B Existing Site Layout (showing embankments around the site) Source: Peter Dann, Drawing No. 10-6561_XX-DR-C150, Rev P1

Appendix C Surface Water Management Plan (A7a, A3d, A7b)

a. Site Characteristics

In order that runoff from the proposed development does not increase flood risk elsewhere, it is recommended that measures are taken to detain runoff on site. As discussed in Section 3.2, the site is relatively impermeable. (Although the underlying gravel formation dos show higer permeability.) In addition, the site is a former landfill, limiting the opportunity for shallow infiltration. Deep infiltration into the gravel formation beneath the landfill could be considered provided a methodology could be devised to prevent contamination from the landfill. This would be dependent on permission from the Environment Agency.

b. Existing Runoff Rates

Existing runoff rates are given in section 3.5 and have been calculated using ReFH2. In addition, the limiting greenfield runoff rates for the surface water management plan were calculated using Marshall and Bayliss methodology (Flood Estimation for Small Catchments, Report 124; Institute of Hydrology, 1994.) The Marshall and Bayliss greenfield runoff Q_{bar} has been calculated as 3.9 l/s/ha.

c. Surface Water Strategy *(Including extracts from Peter Dann 2016a – Cheshunt football club drainage strategy)*

Details of the surface water management plan are given in (Peter Dann 2016a). There follows a digest of this plan including extracts from the plan and additional commentary.

The surface water management systems have been designed using the network module of the WinDes software developed by Micro Drainage/XP Solutions. The following conservative assumptions and design parameters were applied.

- Point rainfalls were obtained using the FEH methodology and increased by 20% to 40% to allow for climate change over the 100 year design life of this development, in line with the requirements of NPPF.
- 100% of the runoff from the proposed impermeable surfaces is directed to the attenuation features (**Table C-1**).
- The outflows from systems 1, 3 and 4 are regulated by a Hydro-Brake Optimum vortex flow control. The outflow from system 2 is pumped. Additional orifice controls are used within system 1.

In accordance with current legislation, the network is assessed for the following return periods:

- *1 in 2 year*
- *1 in 30 year*
- *1 in 100 year + 20% allowance for climate change*

The surface water balancing system has been designed in favour of sustainability to restrict the surface water run-off from the catchment to greenfield run-of rates, therefore ensuring there is no increase to the risk of surface water flooding to on-site and off-site receptors.

The on-site surface water system has been designed to accommodate run-off during all events up to and including the 1 in 100 year plus an allowance for increases in rainfall intensity due to climate change. Given the previous site land use as a landfill the underlying

ground conditions will not be suitable for infiltration methods of surface water disposal, it will be necessary to incorporate attenuation storage within the surface water system.

Based on the current general arrangement layout for the proposed re-development of Cheshunt Football Club limited space is available for open water attenuation features such as ponds and swales. It is proposed that the surface water storage will be provided by a series of below ground attenuation tanks provided with flow control at the outlet from the tank. Discharge from the attenuation storage will be restricted to greenfield run-off rate, Q_{bar} 3.9 l/s per hectare of developed area and will outfall to the Theobald's Brook.

The surface water system for the proposed development is split into four catchments, which in part combine to require two outfalls into Theobalds Brook. Environment Agency consent will be required to discharge into Theobalds Brook.

The surface water drainage systems serving the four catchments are as follows. Details are given in ***Table C-1****.*

System 1 provides surface water drainage for the residential development to the east of the football stadium. The system has been designed not to flood for all rainfall events up to the 1 in 100 year return period plus 20% allowance for climate change. The system incorporates on-line flow control in combination with below ground attenuation storage. Surface flood volumes for rainfall events for the 1 in 100 year return period plus 40% allowance for climate change is to be contained within the kerb lines of the estate roads.

System 2 provides surface water drainage for the football stadium and pitch. The system has been designed not to flood for all rainfall events up to the 1 in 100 year return period plus 40% allowance for climate change. The system incorporates on-line flow control in combination with below ground attenuation storage.

System 3 provides surface water drainage for the car park area serving the football stadium and commercial buildings. The system has been designed not to flood for all rainfall events up to the 1 in 100 year return period plus 40% allowance for climate change. The system incorporates permeable paving surfacing with a tanked voided sub-base to provide attenuation.

System 4 provides surface water drainage for the car parking and estate road to the south of the football stadium. The system has been designed not to flood for all rainfall events up to the 1 in 100 year return period plus 40% allowance for climate change. The system incorporates on-line flow control in combination with below ground attenuation storage.

Table C-1 The Surface Water Systems Characteristics (source Peter Dann)

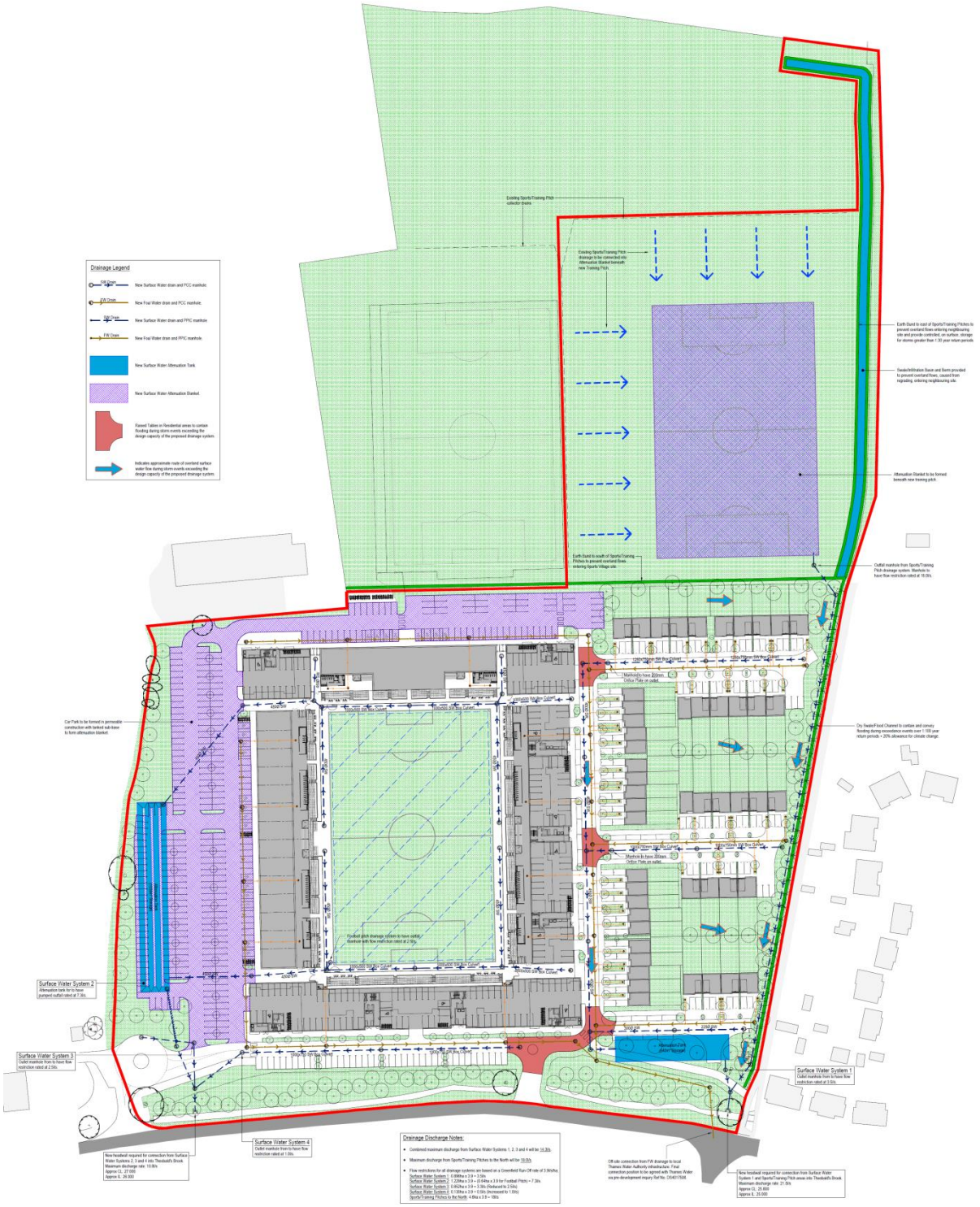
	Area (ha)	Run-Off Coefficient	Q_{bar} (l/s)	Attenuation Volume
Surface Water System 1	0.896	1.0	3.5	540m^3
Surface Water System 2	1.869	1.0	7.3	1093m^3
Surface Water System 3	0.852	1.0	2.5	1182m^3
Surface Water System 4	0.130	1.0	1.0	85m^3

The surface water system has been designed to accommodate flows from the sports pitches to the north of the development site. The surface water system for the sports pitches has also been designed to accommodate run-off during all events up to and including the 1 in

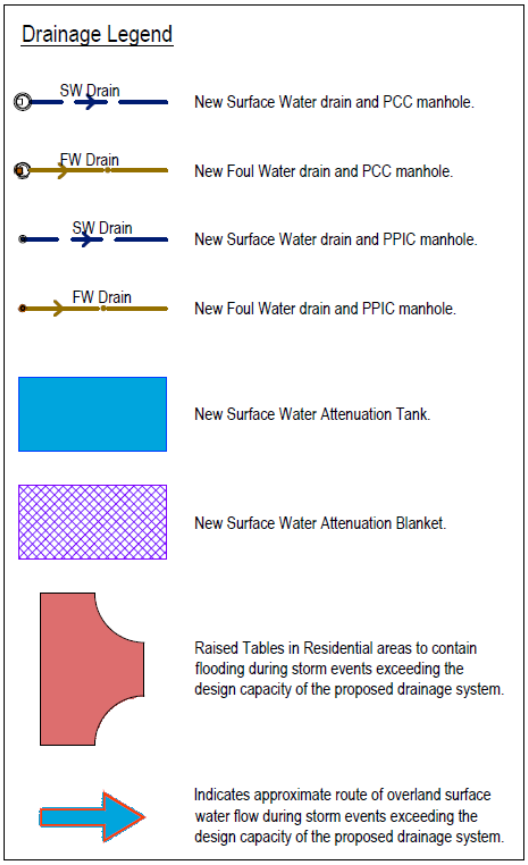
100 year plus an allowance for increases in rainfall intensity due to climate change, with flow restriction to the greenfield run-off rate Q_{bar}.

As part of the surface water drainage strategy it is proposed that rainwater harvesting and greenroofs will be integrated within the design.

Figure C-1 Summary of features of the attenuation design (Enlarged key given on following page, enlarged figure given in Peter Dann 2016a)



Source: Peter Dann Proposed drainage strategy working drawing



d. Residual Risks (A8a, A8b)

In the event that partial blockage went undetected or a rainstorm occurred which was in excess of the 1:100 year+CC design storm, water levels within the tanks could rise above the maximum capacity.

A management and maintenance regime has been proposed (as discussed below) to reduce the risk of partial blockage or other poor performance of the system.

Raised tables have been included in residential areas to contain flooding during storm events exceeding the design capacity of the proposed drainage system.

SURFACE WATER MANAGEMENT AND MAINTENANCE *(extract from Peter Dann 2016a)*

In order for any surface water drainage system to operate as originally designed, it is necessary to ensure that it is adequately maintained throughout its lifetime. Therefore over the lifetime of a development there is a strong possibility that the system could either fail or its performance be reduced if it is not correctly maintained. This is even more important when SuDS form a part of the surface water management system, as these require a more onerous maintenance regime than a typical piped network.

The key requirement of any management regime is routine inspection and maintenance. As part of the detailed design stage an 'owners-manual' will be prepared incorporating the following:

- *A description of the drainage scheme,*

- *A location plan showing all of the SuDS feature and equipment such as flow control devices etc,*
- *Maintenance requirements for each element,*
- *An explanation of the consequences of not carrying out the specified maintenance*

For the SuDS features incorporated within the surface water system regular maintenance will be required in accordance with manufactures details.

Throughout the construction phase, site inspections will be required to ensure that key elements of the surface water system are constructed in accordance with the provided design.

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