CHESHUNT FOOTBALL CLUB – DRAINAGE STRATEGY

For

LW Developments Limited

Job Number: 10-6561

Date: February 2017

NOTICE

This document and its contents have been prepared and are intended solely for LW Developments Limited's information and use in relation to the Structural Performance Specification.

Peter Dann Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 83 pages including the cover.

Document history

Job number: 10-6561			Document ref:			
Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
A	Information	JB	JH	IS	JB	07/09/16
B	Information	JB	JH	IS	JB	09/09/16
C	Information	JB	JH	IS	JB	14/09/16
D	Information	JB	IS	IS	JB	23/09/16
E	Response to HCC Letter dated 30/12/16	JB	IS	IS	IS	23/02/17
F	Response to HCC Letter dated 25/04/17	IS	IS	IS	IS	01/06/17

Client signoff

Client	LW Developments Limited
Project	Cheshunt Football Club
Document title	Drainage Strategy
Job no.	10-6561
Copy no.	F
Document reference	REPORT-2016-09-Drainage Strategy-JB

CONTENTS

1 SURFACE WATER MANAGEMENT OVERVIEW

The development proposals comprise the re-development of the existing Cheshunt Football Club ground and adjoining training pitches to incorporate a new sports stadium with commercial facilities and residential with associated infrastructure.

The Environment Agency's Indicative Flood Risk Map indicates that the site itself lies in Flood Zone 1. Flood zone 1 represents a low probability (less than 1 in 1000 annual probability of river or sea flooding in any year).

The requirements for managing rainfall runoff from developments depend on the pre-developed nature of the site. If it is an undeveloped greenfield site then the impact of the development will need to be mitigated so that the runoff from the site replicates the natural drainage characteristics of the pre-developed site. In the case of brownfield sites, drainage proposals will be measured against the existing performance of the site, although it is preferable for solutions to provide runoff characteristics that are similar to greenfield behaviour.

The overall objective for the surface water strategy is to demonstrate that there will be no increase in:

- the peak rate of storm water runoff leaving the site;
- the volume of runoff leaving the site;
- the pollution load to receiving waters from storm water runoff by following the SUDS 'management train'.

The surface water and foul water drainage proposals are detailed on the following drawings and documents:

- Appendix 1.0 - Drawings
- 10-6561_XX-DR-C152 Surface Water System Drainage Areas
- 10-6561_XX-DR-D201 Proposed Drainage Strategy
- Appendix 2 – Micro Drainage Calculations
- Appendix 3 – Topographic Survey
- Appendix 4 – Thames Water Utility Plan
- Appendix 5 – Environment Agency Correspondence

2 SITE CHARACTERISTICS

2.1 Site Location and Surroundings

Cheshunt Football Club is located in the southwest of Cheshunt with Theobalds Lane form the southern boundary to the site. The site is centred within a grid reference 535555 201352 and covers an area of 7.583ha which comprises 5.664ha development site and 1.919ha sports pitches to the north of the development site.

2.2 Topography

The site is generally flat, topography varies between 30.50-27.50mAOD. The general fall across the site is in a southerly direction. A copy of the topographical survey is included in Appendix 3.

2.3 Geology

The 1:50,000 online British Geological Survey (BGS) map suggests the site is underlain by bedrock of London Clay Formation which is overlain by superficial deposits of Kempton Park Gravel Formation.

Groundwater vulnerability maps for the area indicate the superficial deposits are classified by the Environment Agency as Secondary Aquifer and bedrock as Unproductive Strata. The site does not lie within a catchment of Source Protection Zone for groundwater abstraction.

The site is an historic landfill which received Inert Waste from 1938, which followed its previous use of gravel extraction.

2.4 Hydrology and Hydrogeology

A watercourse named as Theobalds Brook is located on the southern boundary of the site and flows in an easterly direction. The section of Theobalds Brook adjacent to the site is classified as a Main River.

2.5 Existing Drainage

Thames Water is responsible for the operation and maintenance of public sewers within the Cheshunt catchment. Thames Water sewer records show that there is only a foul water sewer network within the vicinity of the site. A 6in diameter foul water sewer is located in Theobalds Lane which accepts flows from the existing football club.

3 SUSTAINABLE WATER STRATEGY (SUDS)

Surface water arising from a developed site should, as far as practical, be managed in a sustainable manner to mimic the surface water flows arising from the undeveloped site.

Appropriately designed Sustainable Drainage Systems (SUDS) can be utilised such that they not only attenuate flows but also provide a level of improvement to the quality of the water passed on to watercourses or into the groundwater table. This is known as source control and is a fundamental part of the SuDS philosophy.

A range of typical SuDS components that can be used to improve the environmental impact of a development is listed in the table below along with the relative benefits of each feature and the appropriateness for the Football Club site.

SUDS Feature	Environmental Benefits	Water Quality Improvement	Suitability For Low Permeability Soils (k<10-6)	Groundwater Recharge	Site Specific Restrictions	Appropriate For Subject Site?
Wetlands	✓	✓	✓	X	Ground Conditions	No
Retention ponds	✓	✓	✓	X	Ground Conditions	No
Infiltration basins	✓	✓	X	✓	Ground Conditions	No
Soakaways	✓	✓	X	✓	Ground Conditions	No
Underground storage	X	X	✓	X	None	Yes
Swales	✓	✓	✓	✓	None	Yes
Filter strips	✓	✓	X	✓	Ground Conditions	No
Rainwater harvesting	✓	✓	✓	✓	None	Yes
Permeable paving	✓	✓	X	✓	None	Yes
Green roofs	✓	✓	✓	X	None	Yes

Infiltration testing undertaken as part of the EPS Phase I & II Geo-Environmental Assessment proved infiltration rates that would be feasible for the use of infiltration methods for surface water disposal.

The historic site use as a landfill will however inhibit the use of shallow infiltration methods due to the potential for concentration of water in the fill materials. As the fill material is not natural and is unlikely to have been subject to any form of compaction and / or treatment this could potentially lead to further settlement and / or deterioration of this material possibly leading to consolidation.

It is noted however, that the natural dense sands and gravels of the Kempton Park Gravel Formation which lay beneath the fill material may be suitable for infiltration if a method for taking site run-off

down to this material can be agreed. This would potentially provide a more sustainable solution by reducing the amount of attenuation required inclusive of reducing off-site disposal of material from excavations. Existing flow paths to Theobalds Brook would also be maintained. Further detailed investigation would be needed to confirm the viability of this method of drainage however, it is considered feasible and could be investigated further during the detailed design phase.

4 SURFACE WATER DRAINAGE

4.1 Surface Water System Statutory Requirements

Guidance from the following documentation will be utilised to develop the site Flood Risk Assessment and the site Surface Water Drainage Strategy.

- Hertfordshire County Council (Lead Local Flood Authority) Surface Water Guidance.
- Department for Communities and Local Government National Planning Policy Framework, 2012.
- CIRIA 753, 2012: The SuDS Manual This document provides current best practice national guidance on the planning, design, construction, operation and maintenance of SuDS to facilitate their effective implementation within developments.
- Flood Estimation for Small Catchments, Report 124; Institute of Hydrology, 1994.
- EA / DEFRA Report SC030219: Rainfall Run-off Management for Developments.
- Sewers for Adoption- A Design and Construction Guide for Developers Seventh Edition, 2011.

The on-site surface water system will be designed to accommodate run-off during all events up to and including the 100 year return period plus allowance for increases in rainfall intensity due to climate change. In line with current legislation the surface water system has been designed to accommodate the following climate change allowances.

- The allowance for climate change 'central estimate' of 20% is used for design purposes to assess the performance of the drainage system and ensure it can cope with the critical duration design rainfall event.

- The allowance for climate change 'upper end' of 40% is used in sensitivity analysis to assess the potential flood risk implications both on and off-site in the critical duration design rainfall event. When using the upper end figure it must be ensured that surface water is wholly contained on site and that flood hazard is within acceptable tolerances using the Defra/Environment Agency document (Flood Risk Assessment Guidance for New Development) (ref: FD2320)

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 will be 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.

4.2 Existing Surface Water Discharge Regime

Currently no surface water drainage provisions exist on the site, as such surface water run-off from the site is via infiltration and through flow / overland flow to the watercourse Theobalds Brook on the southern boundary.

4.3 Surface Water Discharge Options

Part H of the Building Regulations 2002 recommends that surface water run-off shall discharge to one of the following, listed in order of priority:

- an adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable,
- a watercourse, or, where that is not reasonably practicable,
- a sewer.

Infiltration testing as undertaken as part of the site geo-environmental investigation has confirmed that prevailing ground conditions are not suitable for the use of shallow infiltration methods due the historic site use as a landfill. However, as noted in Section 3, consideration could be given to extending drainage into the natural dense sands and gravels below the made ground should further investigation confirm suitability for infiltration and an acceptable method for dispersal can be agreed.

An existing watercourse Theobalds Brook is located on southern boundary of the site. The site topography is such that it is feasible to outfall the surface water run-off from the developed site to this watercourse.

There is no public surface water sewer system within the vicinity of the site, and connection to the public foul water sewer would not be permitted by Thames Water.

4.4 Surface Water Strategy

The on-site surface water system will be 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 for works to and adjacent to Theobalds Brook. Given that the proposed development is discharging clean surface water into the Brook, Environment Agency consent to discharge will not be required.

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 also largely contained within the attenuation system proposed with only a minor informal flood volume requiring containment within the kerb lines of the southernmost estate road.

Attenuation for System 1 is largely provided within the sub-base beneath permeably paved access roads discharging to this branch of the drainage system. Permeable paving is a SuDS technique that is appropriate to use at most developments including the proposed development and provides both a flood reduction benefit due to the attenuation provided in the base areas and also a pollution reduction benefit due to the filtration of water as is passes through the permeable surfacing. The sub-base will have at least a 30% void ratio and will be lined with an impermeable membrane to protect the sub-surface environment from the risks identified in the EPS Phase I & II Geo-Environmental Assessment as outlined in Section 3.

Run-off from the roof areas is also proposed to be drained to the base of permeably paved access areas, passing through a membrane such as Terram upon entry/exit from the base layer to provide filtration and removal of potential pollutants.

The balance of the attenuation volume required for System 1 will be provided within a stormwater attenuation tank situated immediately south of the southern residential access road. The tank will house the flow control restricting discharge to Theobalds Brook.

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. The water stored in this attenuation tank will also be utilised for irrigation of the developments football pitches.

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 filtration and 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 the estate road having a permeable surface over a tanked voided sub-base to provide filtration and attenuation.

The table below summarises the surface water system catchment characteristics.

	Area (ha)	Run-Off Coefficient	Q_{bar} (l/s)	Attenuation Volume
Surface Water System 1	0.896	1.0	3.5	938m3
Surface Water System 2	1.869	1.0	7.3	1093m3
Surface Water System 3	0.852	1.0	2.5	1182m3
Surface Water System 4	0.130	1.0	1.0	112m3

The surface water system will be designed to accommodate flows from the sports pitches to the north of the development site. The surface water system for the sports pitches will also be 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 green-roofs will be integrated within the design. An Agronomist will be consulted for the design of the drainage system for the football pitch.

5 SURFACE WATER MANAGEMENT AND MAINTENANCE

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 manufacturer's 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.

6 APPENDIX 1 – DRAWINGS

- 10-6561_XX-DR-C152 Surface Water System Drainage Areas
- 10-6561_XX-DR-D201 Proposed Drainage Strategy

DO NOT SCALE THIS DRAWING - IF IN DOUBT ASK

NOTES

1. This drawing is to be read with all other relevant drawings and Specifications

Drainage Areas:

- Surface Water System 1 Impermeable Area: 0.896ha
- Surface Water System 2 Impermeable Area: 1.229ha
- Surface Water System 2 Football Pitch: 0.640ha
- Surface Water System 3 Impermeable Area: 0.852ha
- Surface Water System 4 Impermeable Area: 0.130ha

PL1 07.09.16 (MD) Drawing raised to Planning status.

AMENDMENTS

peter dann consulting engineers

peter dann limited | newton house
cambridge road | barton | cambridge | CB23 7WJ
t: 01223 264688 www.peterdann.com info@peterdann.com

JOB TITLE

CHESHUNT FOOTBALL CLUB
CHESHUNT

DRAWING TITLE

SURFACE WATER SYSTEM DRAINAGE AREAS

DATE	DRAWN	SCALE
SEP '16	MD	1:500 @A1

DRAWING STATUS

PLANNING

JOB No.	DRAWING No.	REV
10-6561_	XX-DR-C152	PL1