PP/11/2421 e PP/11/3352

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The Phene Arms, 9 Phene Street,

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Flood Risk Assessment and Sustainable Drainage Strategy

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ExD	HPC	H&S	HPD	HoE	Policy	Design	Trees
DC		Received Keke Planning				Reg	PIO
Enf		24 JAN 2012				LLD	Appeals
Str Dev		N&N	Obj	Supp	No Obj	Rev	Other

Ref: 110711/TG
Date: 04 January 2012
Rev No: Rev 1.1

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Table of Contents

1.0 INTRODUCTION 4

2.0 BACKGROUND 4

2.1 General Documentation 4

2.2 Site Specific Documents 5

3.0 EXISTING SITE 6

3.1 Location 6

3.2 Existing Site Description and Topography 6

3.3 Ground Conditions 6

3.4 Existing Site Drainage 7

3.5 Existing Site Characteristics 7

4.0 PROPOSED DEVELOPMENT 8

4.1 Description 8

4.2 Vulnerability Classification 8

4.3 Local Development Documents 8

4.4 Sequential Test 8

5.0 DEFINITION OF THE FLOOD HAZARD 10

5.1 Sources of Flooding 10

5.2 Probability of Flooding 14

5.3 Flood Risk due to Climate Change 14

6.0 PROPOSED SURFACE WATER DRAINAGE STRATEGY 15

6.1 Site Characteristics 15

6.2 Proposed Surface Water Strategy 15

6.3 Site Design Objectives and Constraints 16

6.4 Sustainable Drainage Systems (SUDS) 16

6.5 SUDS Selection Criteria 19

6.6 Suitable SUDS Options 21

6.7 Assessment of Appropriate SUDS Technique 25

7.0 FOUL WATER DRAINAGE 25

8.0 FLOOD RISK MANAGEMENT MEASURES 25

9.0 OFFSITE IMPACTS 25

10.0 RESIDUAL FLOOD RISKS....25

11.0 COMPLIANCE WITH CODE FOR SUSTAINABLE HOMES REQUIREMENTS....26

11.1 Sur 1 - Management of Surface Water Run-off....26

11.2 Sur 2 – Flood Risk....26

11.3 Points Achieved....26

12.0 RECOMMENDATIONS....26

13.0 CONCLUSION....27

1.0 INTRODUCTION

Conisbee have been appointed as Civil Engineering Consultants to undertake a Flood Risk and Sustainable Drainage Assessment for the proposed residential development at the Phene Arms, 9 Phene Street in London.

This Flood Risk Assessment will be undertaken in accordance with the best practice guidance stated in PPS 25, pursuant to Environment Agency approval and to informing the design. It is also a mandatory requirement for the Code for Sustainable Homes (CfSH). The proposed residential development has been set a minimum target CfSH target of Level 4. This Flood Risk Assessment demonstrates how Credits under criteria Sur 1 and Sur 2 have been met.

2.0 BACKGROUND

This flood risk assessment refers to the following documents.

2.1 General Documentation

2.1.1 Planning Policy Statement 25 (PPS25) Development and Flood Risk (TSO, March 2010)

PPS25 sets out government policy on development and flood risk. The aim is to ensure that flood risk is taken into account at all stages of the planning process and that inappropriate development is not undertaken within areas of flood risk.

2.1.2 Royal Borough of Kensington & Chelsea Strategic Flood Risk Assessment (SFRA, August 2009)

This SFRA was prepared on behalf of Kensington & Chelsea by JBA Consulting. It defines the flood risks within the Borough and advises on flood risk management in accordance with the requirements of PPS 25.

2.1.3 The Royal Borough of Kensington & Chelsea Core Strategy (Kensington & Chelsea, December 2010)

The Kensington & Chelsea adopted Core Strategy states that the Borough has some of the highest residential densities in the country in terms of both built density and population density. The London Plan has a density matrix (Table 3A.2) based on a sophisticated mix of setting in terms of location, existing built form and massing and the index of public transport accessibility (PTAL), which defines appropriate density ranges for a site or for areas within the Borough.

There are few vacant sites remaining in the Borough and the provision of new housing, other than from conversion schemes, will mainly arise from smaller-scale redevelopment proposals. The Borough seeks to maximise the residential capacity of the Borough by ensuring that, wherever possible, the development of vacant land and redevelopment of property currently in other uses is for residential purposes, while seeking to maintain residential amenity. The Borough has a target to deliver 350 houses per year between 2007 and 2016.

2.1.4 Code of Sustainable Homes (CfSH) (DCLG, December 2010)

This is an environmental assessment method for rating and certifying the design and construction of new residential houses with a view of encouraging continuous improvement in sustainable urban development, construction and use. It includes objectives for the management of surface water and flood risk.

2.2 Site Specific Documents

The following documents and drawings have been consulted for the preparation of this flood risk assessment.

- *Appendix A – Site Boundary Plan & Topographical Survey*
- *Appendix B – Geological Maps*
- *Appendix C – Thames Water Asset Location Plan*
- *Appendix D – Extracts from SFRA*
- *Appendix E – Greenfield Runoff Calculations*
- *Appendix F – Preliminary Drainage Layout & Site Proposals*
- *Appendix G – The SUDS Management Train*

3.0 EXISTING SITE

3.1 Location

The site is located at NGR 527321 177847 in London. The site is bound on its side by the following:

- To the north and east the site is immediately bounded by residential premises of Chelsea suburb of London.
- To the west the site in bound by Margaretta Terrace, with residential dwellings located beyond this road.
- To the south the site is bound by Phene Street, with residential premises located beyond this road. The River Thames is located further south approximately 250m away of the site.

3.2 Existing Site Description and Topography

The site comprises of the Phene Arms "gastro pub". The Pub currently consists of a double storey building including basement. The site to be developed measures approximately 365m².

In terms of topography the site is mostly occupied by the existing building and considered to be flat at an average level of approximately 6.500m AOD. The existing topographical site survey is contained in Appendix A.

3.3 Ground Conditions

The Geological maps obtained from Landmark indicate that the site is underlain by the following geological sequence; Made Ground underlain by Kempton Park Gravel sitting on London Clay. An intrusive ground investigation report is yet to be undertaken. The geological maps are contained in Appendix B.

Aquifer Designation

The Environment Agency has recently amended their aquifer designations so that they are consistent with the Water Framework Directive. The Superficial (Drift) map at this location indicates that the site is underlain by a Secondary A Aquifer. Secondary A aquifers are defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers. No aquifer would be expected in the London Clay Bedrock geology.

Source Protection Zone

The site is not located in the source protection zone.

3.4 Existing Site Drainage

Most of the site is occupied by the Phene Arms building together with a driveway and hard paved courtyard along its frontage facing onto Magaretta Terrace. A CCTV survey is yet to be commissioned however Thames Water records indicate that there is a 1100 x 800 combined trunk sewer running through Magaretta Terrace which passes also through Phene Street. The location of the outfall manhole from the site can be assumed to discharge into this combined trunk sewer. The Thames Water records showing drainage within the vicinity of the site are contained in Appendix C.

The locations and conditions of the outfall manholes and potential drainage are to be investigated by undertaking CCTV Survey.

3.5 Existing Site Characteristics

The existing hydrological characteristics for the site are as follows:

- Area of Development Site = 365m^2
- Total Existing Impermeable Area assessed to be 12% = 45m^2
- Existing run off rate Q_{WR}= 5,5l/s
- Infiltration rate = Unknown

4.0 PROPOSED DEVELOPMENT

4.1 Description

It is proposed to replace the existing pub with one new residential dwelling consisting of the following:

- *Second Floor Plan – Details pending.*
- *First Floor Plan – Details pending.*
- *Ground Floor Plan – Study, kitchen, dining room, drawing room, and skylight to swimming pool below.*
- *Lower Ground Floor Plan – Light well, 2 bedrooms with ensuites, balcony, utility and cinema room.*
- *Basement Plan – Play room / guest bedroom, sauna & steam rooms, wine store and luggage room.*
- *Lower Basement Plan – swimming pool with light well extending to the ground level and void for services.*

4.2 Vulnerability Classification

Table D.2: Flood Risk Vulnerability Classification, Annex D of PPS 25 shows that the intended residential use of the proposed housing development has a Vulnerability Classification of "More Vulnerable". However the site is located in Flood Zone 2.

4.3 Local Development Documents

The Kensington & Chelsea adopted Core Strategy states that the Borough has some of the highest residential densities in the country in terms of both built density and population density. The London Plan has a density matrix (Table 3A.2) based on a sophisticated mix of setting in terms of location, existing built form and massing and the index of public transport accessibility (PTAL), which defines appropriate density ranges for a site or for areas within the Borough.

There are few vacant sites remaining in the Borough and the provision of new housing, other than from conversion schemes, will mainly arise from smaller-scale redevelopment proposals. The Borough seeks to maximise the residential capacity of the Borough by ensuring that, wherever possible, the development of vacant land and redevelopment of property currently in other uses is for residential purposes, while seeking to maintain residential amenity. The Borough has a target to deliver 350 houses per year between 2007 and 2016.

4.4 Sequential Test

The Environment Agency Flood Plain map indicates that the site is located in Flood Zone 2. This has also been confirmed by the Environment Agency correspondence contained in Appendix D. Flood Zone 2 comprises of land assessed as having a less than 1 in 100 annual

probability of river or sea flooding in any year (<1.0%). Table D.3: Flood Risk Vulnerability and Flood Zone 'Compatibility', Annex D of PPS25, shows that the development is appropriate for this zone and therefore the Exception Test is not required.

5.0 DEFINITION OF THE FLOOD HAZARD

5.1 Sources of Flooding

The Royal Kensington and Chelsea Borough Council Strategic Flood Risk Assessment (SFRA) has identified the potential sources of flooding for this area, in accordance with Annex C of PPS25, which may affect the site. These sources are discussed below.

5.1.1 Fluvial Flooding

There are effectively no areas of functional floodplain within borough. Most of the Borough lies within Flood Zone 1. Only a small area adjacent to the River Thames falls within Flood Zones 2 and 3. The site is in Flood Zone 2, and is located 250 away from the banks of the River Thames. However the River Thames has flood defences providing flood protection up to and including the 1 in 1000 year storm event, therefore the site is considered to be at low risk from fluvial flooding.

5.1.2 Tidal Flooding

The River Thames through central London is primarily a tide dominated river and the most severe flood risks come from tidal surges. Teddington is the normal tidal limit although high fluvial flows can affect parts of west London and extreme surges can affect upstream of Teddington. The Tidal Thames floodplain is currently defended through a combination of raised banks and barriers, the most important being the Thames Barrier at Woolwich including eight other major barriers. These defences provide protection against tidal flooding to an estimated 1 in 1000 year standard up to 2070 (statutory flood defence level), which equals a less than 0.1% chance of flooding each year. So far the rate of sea level rise has not exceeded that expected and the defences are thus currently providing a greater level of protection than 1 in 1000 years. The existing statutory flood defence level in Kensington and Chelsea is 5.41m AOD downstream of Putney Bridge, and 5.54m AOD upstream. These flood defences are defined as being 'Good' in accordance with the Environmental Agency's National Fluvial and Coastal Flood Defence Database (NFCDD). The extent of these flood defences can be seen on Map 12 of in Appendix D of this report.

The last tidal flood event in Kensington and Chelsea occurred in 1928 causing death from flooded habitable basements. However EA flood data contained in Appendix X indicates that this flood event historically occurred south of the River Thames.

Environment Agency Flood Data

The Environment Agency has provided flood data applicable to the site which is contained in Appendix X. The EA have stated that the site lies just outside the extreme flood outline and as such they do not have a Tidal Flood data applicable for the site. The EA have however provided flood data for the nearest node 2.28; whose flood levels are influenced by the astronomical tide, the surge tide and fluvial incoming river flows of the River Thames Catchment. The applicable 1 in 100 year and 1 in 1000 year flood levels are 5.01m AOD and 5.04m AOD respectively. This flood data indicates that the site is protected by flood defences upto the statutory flood level of 5.41m AOD.

Climate Change – Sea Level Rise

PPS 25 states when setting Finished Floor levels of proposed developments Sea Level Rise induced by the incidence of Climate Change should be considered for all tidal flood events. The table below provides details of the anticipated Net Sea level rise in accordance with Defra FCDPAG3.

Table 5.1 – Climate Change Regional Net Sea Level Rise Allowances

East of England, East Midlands, London, Southeast England	4.0	8.5	12.0	15.0
South West	3.5	8.0	11.5	14.5
Northwest England	2.5	7.0	10.0	13.0

- ***2011 to 2025 : 14 x 4.0mm/yr = 56mm***
- ***2025 to 2055 : 30 x 8.5mm/yr = 255mm***
- ***2055 to 2085 : 30 x 12.0mm/yr = 360mm***
- ***2085 to 2111 : 26 x 15.0mm/yr = 390mm***
- ***Therefore total Sea Level Rise – 1,061mm***

Applying the anticipated 1,061mm sea level rise from the year 2011 to 2111 to the 1 in 100 year flood event at node 2.28 would result in a flood level of 6.071m AOD for the 1 in 100 storm event in 2111. The EA recommends that a freeboard be allowed above predicted flood levels in order to address the inherent sensitivity of design flood levels to inaccuracies in the estimation process and of the potential implications of any physical processes, such as

settlement of the structure or waves increasing water levels. Applying a 600mm freeboard would result in an applicable Finished Floor Level of 6.671m AOD. Therefore the proposed ground floor Finished Floor Level of 7.000m AOD would provide an adequate threshold to protect against the egress of storm water in extreme weather events. Secondly the all light wells will be constructed with extended physical boundary enclosures with an exposed threshold level set at 6.700m AOD, thus providing a robust mechanism for protection of the proposed dwelling against the egress of surface water in extreme weather events.

Future Tidal Flood Defence Management

The Environment Agency has a comprehensive programme of study (Thames Estuary 2100) that is ongoing to establish the best approaches to manage the effects of climate change on

the level of defence provided. A number of measures have been identified that could be implemented depending on the sea level rise and increase in surges that may be experienced over the next 100 years.

In terms of the proposed below ground levels uses the following has to be considered:

- Assessment of the proposed basement levels, ground levels, floor levels and threshold levels of any openings to the basement (Subject to EA Flood Level information). The current proposals provide 500mm freeboard from adjacent footway levels and 650mm freeboard from the adjacent road levels.
- The site is located 250m north of the River Thames.
- Time to onset of flooding and velocities, when assessing the risk to basements. The SFRA provides details of Breach Analysis carried out along the River Thames, results of this exercise indicate that the site is note prone rapid inundation as highlighted in Map 13 of the SFRA contained in Appendix D of this report.
- The use of secondary flood defences to the basement, barriers on doors and the use of flood resilient materials is recommended.

Therefore the risk of tidal flood risk is low at this site.

5.1.3 Overland Flooding

Overland flooding can occur when high intensity rainfall overwhelms man made drainage systems or cannot soak into the ground. Excess water can flow across the ground and cause flooding. It is exacerbated by steep topography. Overland flooding is often represented by very large expanses of recorded flooding events.

This type of flooding is not discussed in the SFRA, as the area containing the site is a densely built up urban area and is situated 250m from the low-lying areas adjacent to the River Thames. However and more appropriately Surface Water and Sewer Flooding are discussed in the sections below.

5.1.4 Groundwater Flooding

Groundwater flooding occurs when subterranean water flows back above ground, this occurs at the point where the water table meets the surface. Groundwater flooding will only occur in or near areas where the underlying rocks and soils are capable of transporting significant quantities of water. The Phene Arms pub site is underlain by impermeable London Clay Layer, which protects the site from groundwater movements. The SFRA does not indicate any recorded groundwater flooding events; therefore this site is not susceptible to groundwater flooding.

5.1.5 Surface Water Flooding

Traditionally surface water sewer networks are designed to cope with storm events up to and including the 1 in 30 year storm event. If this storm event is exceeded surface water flooding would occur following the topography of the area subjected to the flooding event. There are no surface water sewer within site vicinity, large combined sewers which are maintained by Thames Water.

There are two trunk combined sewers collecting both foul water discharge and surface water runoff. These sewers might become overloaded and the surface water runoff will overflow from gullies and manhole covers. In 2007 373 properties were flooded in the Borough. This flooding event resulted in flood water depths up to 100mm in the vicinity of the site as cane be seen in Map 17 of the SFRA contained in Appendix D. However the Ecology and Hydrology Centre have indicated that the 2007 summer flood events were exceptional flood events and no similar trends could be expected in the future. Therefore this site is at very low risk to surface water flooding.

5.1.6 Sewer Flooding

The SFRA states that sewer flooding records kept by Thames Water for the 10 year period 1999 to 2009 indicates that between 51 to 100 sewer flooding events occurred in postcode SW3 containing the site. This can be seen on Map 18 contained in Appendix D of this FRA. Thames Water operates flood response units to address any flooding incidents, they also actively manage and rectify areas experiencing recurrent flood events. This dataset demonstrates that while the incidence of sewer flooding is of concern within the vicinity of the site. As stated above this type of flood risk is actively managed by Thames Water resulting in a low residual risk from this type of flooding event.

5.1.7 Flooding from Artificial Sources

There are no canals, docks and basins within the immediate vicinity or adjacent to the Phene Arms site. Therefore this assessment concludes that, there is no risk of flooding from the identified artificial sources.

5.2 Probability of Flooding

As discussed above the probability of flooding within this site from any source is minimal as long as the onsite drainage for the site is suitably designed, appropriate threshold levels set and adequate onsite attenuation is provided.

5.3 Flood Risk due to Climate Change

The effect of climate change will be to increase the intensity and duration of rainfall events, thus increasing the likelihood of localised flooding. It is current policy therefore to add 30% to design rainfall profiles when designing surface water drainage to accommodate future increases.

In this case the drainage will be designed to retain the 1 in 100 year + 30% for climate change storm event within the proposed drainage system.

6.0 PROPOSED SURFACE WATER DRAINAGE STRATEGY

6.1 Site Characteristics

The physical design and hydrological characteristics for the site are as follows;

- Total Catchment Area = 385m^2
- Total proposed impermeable Area = 74m^2
- Nett decrease of impermeable area after development = 29m^2
- Both the London Plan and PPS 25 guidance is to discharge surface water from both Greenfield and brownfield sites at Greenfield discharge rates.

The applicable Greenfield runoff rates for the 1 year, 2 years, 30 years and 100 years return periods are contained in Appendix E.

6.2 Proposed Surface Water Strategy

In accordance with best practice guidelines stipulated in PPS 25, it is proposed to provide attenuation up to and including the 1 in 100 year plus 30% for the Climate Change storm event for this site. The attenuation facilities will be provided. The attenuation will consist of underground modular storage units with hydro-brake flow control units restricted to 5.0 l/s. These will attenuate surface water runoff from the private driveways, car parking areas and roof tops. The site will be served by a combined water outfall manhole. This manhole will discharge the runoff into the public combined sewer in Magaretta Terrace. The Proposed Drainage Layout drawing can be found in Appendix F.

In terms of pollution control all surface water manholes will be catchpits and the hydrobrake chambers will consist of cut off valves to stop flows in emergencies. Trapped gullies will also be introduced in all the other proposed hard paved areas.

<u>Rate of Discharge & Proposed Outfall</u>

The Building Regulations recommend a hierarchy of methods of disposal of surface water. In order, these are disposal by infiltration, discharge to watercourses and if neither of these options are reasonably practical then discharge to a public surface water sewer. Chapter 6 of the Mayor's Draft Water Strategy (Rainwater in London) sets out a similar hierarchy. The objective is for surface water discharged from urban developments to replicate the predevelopment response of the site as far as possible.

Further the Code for Sustainable Homes, the Mayor's London Plan and PPS 25 all require that the discharge from all Greenfield and Brownfield development sites be limited to Greenfield runoff rates. The applicable greenfield runoff rates for the site are very small owing to the limited size of the overall area of this proposed development. The proposed rate of discharge for this development is 5l/s, as this is the smallest hydrobrake that would facilitate hydraulic efficiency and would not be prone to blockages. Therefore the applicable surface water discharge rate is 5l/s for all storm events up to and including the 1 in 100 year plus 30% for climate change storm event. The surface attenuation required is $10m^3$.

6.3 Site Design Objectives and Constraints

The requirements for a sustainable surface water drainage strategy at this site are to:

- Limit the peak rate of surface water discharge into the public sewer to the predevelopment level,
- To attenuate all storm events up to and including the 1 in 100 year storm plus climate change event.
- Prevent pollution of the groundwater

Infiltration drainage techniques have been precluded owing to site constraints and the underlying geology.

6.4 Sustainable Drainage Systems (SUDS)

SUDS is a term used to describe the various approaches that can be used to manage surface water drainage in a way that mimics the natural environment. SUDS can improve the sustainable management of water for a site by:

- reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- reducing volumes and the frequency of water flowing directly to watercourses or sewers from developed sites;
- improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- reducing potable water demand through rainwater harvesting;
- improving amenity through the provision of public open space and wildlife habitat;
- replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

The SUDS Manual, CIRIA C697, provides a hierarchy of techniques that which will incrementally reduce pollution, flow rates and volumes and this is called The SUDS Management Train. The methods are categorised depending on whether their primary use is considered to be pre-treatment, conveyance, source, site or regional controls, and they can be ranked based on their hydraulic and water quality performance potential. Table 1 categorises the capability of different SUDS techniques. Table 3.3 of the SUDS manual indicates how many components are recommended to deal with the runoff from differing land uses.

Further information describing the SUDS management train is attached at Appendix G.