3.6 Geotechnical information

3.6.1 Geology

3.6.1.1 Published geology

London belongs to the Thames Basin which is a broad syncline of chalk occupied in its center by sands and clays. Fluviatile deposits associated with the former deposits of the River Thames lie on top of the bedrock. These different terraces are the remains of the river's floodplains.

The geology from previous boreholes on and around the site indicates the build-up to be Made Ground overlying Terrace Gravel underlain by the London Clay. Underlying the clay are Reading beds, Thanet Sand and Chalk. Geological maps from Envirocheck reports show that the area has not been significantly modified by artificial ground.

3.6.1.2 Previous ground investigations

Based on the site investigation, Geological maps and information from the borehole logs, the geology has been identified and is described in the following sections.

Made Ground

Made Ground surrounding the building typically is around 1.0-1.9m in depth and comprises of asphalt, sometimes underlain by a lean mix concrete underlain by re-worked sand and gravel/clay with occasional brick fragments. Deeper levels of Made Ground may be found in the proximity of the townhouses demolished to make way for the cinema.

Terrace Gravels

Terrace Gravels were found in all boreholes and is generally around 3m thick ranging between depths of 7.5m OD down to 2.75m OD. These consist of gravel, which is sandy and clayey in parts. There is a perched water table within the gravels.

London Clay

London Clay was encountered in all the boreholes at a depth of between 5.10m OD and 2.75m OD. The boreholes suggest the OD level of the top of the London Clay decreases towards the south of the site. The London Clay varied between 3.90m and 5.90m below ground level. London Clay is well documented locally and is generally weathered with siltty sandy bands and Limestone nodules, becoming firm grey fissured clay with depth.

Woolwich and Reading Beds/Lambeth Group

Reading Beds were encountered at a horizon depth of approximately -50m OD in the boreholes located close to the site. The thickness of the bed was around 15 to 20m. These can be described as a variable series of clay, loam, sand and pebble beds which are locally cemented into sandstone or conglomerate. The sands are generally yellow, greenish, or brown and contain layers of mottled clay occasionally with bands of lignite. The base of this stratum is formed of greenish sand with flint pebbles where Thanet Sands are present below.

Thanet Beds

Thanet sands were encountered at a depth of between -62m OD to -73m OD in the boreholes located close to the site. The strata comprised of greenish sand, fine-grained sand. The colour varies between greenish and brownish grey. At the surface, the sands weather to a pale yellowish grey. At the base, the strata comprising of a conglomerate of rounded flint pebbles and almost unworn nodular flints. The flints are typically coated with dark green glauconite and lie within a matrix of glauconitic sandy clay.

Upper Chalk

Upper chalk was encountered at a depth of between -70m OD to -83m OD in the boreholes located close to the site. The thickness of the strata was around 7 to 10m. The Upper Chalk band is softer than the Middle Chalk. Flints are abundant as a general rule. The base of the division is a hard band called the Chalk Rock, which in the area north of the Thames, is the most prominent horizon in the Chalk. It consists of one or more beds of hard, creamy limestone each approximately 1 foot thick, usually with scattered green grains of glauconite. Between the creamy limestone bands are layers of hard nodular chalk formed in a softer matrix.
3.6.1.3

Ground conditions

Initial assessment of the ground conditions was based on the ground investigation factual report by Ground Engineering (on behalf of Alan Conisbee & Associates) in addition to record information from BGS boreholes. There is no evidence to suggest that this site is unusual for the West London area and on the basis of the information and AKTII’s experience of geology local to the site, initial design parameters are presented below. Further detail is now also presented in the GCG interpretive report dated January 2015 based on the site investigation data. Detailed design will be carried out based on the parameters determined within the interpretative report.

The location of the boreholes from the site investigation are shown in the adjacent figure.

The following table gives the typical geotechnical properties of the different soil layers:

<table>
<thead>
<tr>
<th>Strata Level at top of strata</th>
<th>North (BH D)</th>
<th>South (BH C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made Ground</td>
<td>+10.15</td>
<td>+8.35</td>
</tr>
<tr>
<td>Terrace Ground</td>
<td>+7.55</td>
<td>+5.65</td>
</tr>
<tr>
<td>London City</td>
<td>+4.85</td>
<td>+2.75</td>
</tr>
<tr>
<td>Lambeth Group</td>
<td>-39.85</td>
<td>-41.65</td>
</tr>
</tbody>
</table>

Table 4: Stratum underlying the site

<table>
<thead>
<tr>
<th>Strata</th>
<th>Drained Density (kN/m³)</th>
<th>Submerged Density (kN/m³)</th>
<th>N Value Dry (degree)</th>
<th>Submerged (degree)</th>
<th>Angle of internal Shearing Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drifts</td>
<td>16.5 - 21.0</td>
<td>9.0 - 12.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>London Clay - Weathered</td>
<td>17.0 - 21.0</td>
<td>9.0 - 12.0</td>
<td>8 - 30</td>
<td>14.0</td>
<td>14.0</td>
</tr>
<tr>
<td>London Clay - Unweathered</td>
<td>23.0 - 30.0</td>
<td>15.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Typical soil properties of London Clay

<table>
<thead>
<tr>
<th>Type of London Clay</th>
<th>Cu (kPa)</th>
<th>Density (MN/m³)</th>
<th>Bulk Density (MN/m³)</th>
<th>Liquid Limit (%)</th>
<th>Plastic Limit (%)</th>
<th>Plasticity Index (%)</th>
<th>Compaction-Max DD (Mg/m³)</th>
<th>Optimum MC (%)</th>
<th>CBR (%)</th>
<th>Swell Pressure (kN/m³)</th>
<th>pH</th>
<th>SPT (N≤100)</th>
<th>Clay (%)</th>
<th>Silt (%)</th>
<th>Sand (%)</th>
<th>Gravel (%)</th>
<th>Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weathered</td>
<td>72.0 - 137.0</td>
<td>1.43 - 1.54</td>
<td>1.88 - 1.95</td>
<td>70.0 - 84.0</td>
<td>23.0 - 29.0</td>
<td>44.0 - 57.0</td>
<td>1.58 - 1.81</td>
<td>3.5 - 7.5</td>
<td>34.0 - 85.0</td>
<td>7.0 - 7.7</td>
<td>32.0</td>
<td>47.0 - 63.0</td>
<td>30.0 - 42.0</td>
<td>0.0 - 11.0</td>
<td>0.0</td>
<td>270 - 32.0</td>
<td></td>
</tr>
<tr>
<td>Unweathered</td>
<td>98.0 - 203.0</td>
<td>1.50 - 1.60</td>
<td>1.92 - 1.98</td>
<td>69.0 - 86.0</td>
<td>24.0 - 29.0</td>
<td>43.0 - 58.0</td>
<td>1.56</td>
<td>5.0</td>
<td>76.0 - 297.0</td>
<td>7.1 - 7.7</td>
<td>36.0</td>
<td>57.0</td>
<td>43.0</td>
<td>5.0</td>
<td>0.0</td>
<td>25.0 - 30.0</td>
<td></td>
</tr>
</tbody>
</table>
3.6.2 Hydrogeology and hydrology

3.6.2.1 Environment Agency classification

London Clay effectively divides London hydrology into two units: upper aquifer, primarily formed by Pleistocene terrace deposits; and lower aquifer, primarily formed by Upper Chalk often in combination with the overlying Thanet Sands.

The Environment Agency’s new aquifer designation map indicates that the site is underlain by a Secondary A superficial aquifer and an unproductive bedrock Strata.

The groundwater vulnerability map from Envirocheck reports indicates the site as a high minor aquifer (variably permeable). The London Clay should be classified as a non-aquifer. A Secondary A aquifer is defined by the environment Agency as the site is not located within an Environment Agency (EA) designated groundwater source protection zone. The EA has defined Groundwater Source Protection Zones (GSPZs) for sources used in the supply of public drinking water.

A summary of the hydrogeological properties of main geological units underlying the site is shown in the table 3 below.

3.6.2.2 Hydrology and Lost Rivers

The River Thames is located 3.0km to the South of the site. The majority of the natural tributary rivers of the River Thames have been culverted or infilled as development of the city has progressed. Barton’s map (1992), indicates that the lost River Counters Creek once flowed 500m from the site but has since been enclosed in underground conduits. There are no scour hollows (also termed drift filled hollows) in the vicinity of the site. Scour hollow or drift-filled hollows are cavities filled with weak materials.

The EA flood map indicates that the site has a low risk of flooding and is located in Flood Zone 1.

3.6.2.3 Groundwater level

The cessation of abstraction from the chalk after the mid 1960s for industrial purposes caused groundwater levels to rise throughout the London basin. GARDIT (General Aquifer Research, Development and Investigation Team) was developed in order to minimise and ultimately halt the groundwater rise, but the EA’s view is that rising groundwater no longer poses a problem and underground infrastructure is no longer threatened by inundation.

Groundwater levels are subjected to variations caused by changes in the local drainage conditions and also by seasonal effects.

Monitoring of the groundwater on the site has shown there to be a perched water table which sits on top of the impermeable London Clay at a depth of between 3.60m and 5.10m below ground level (between 6.60mOD and 3.55mOD). Monitoring indicates that this level fluctuates. For a details of the anticipated interaction of the proposed basement with the perched water table, refer to section 4.9.2.

Strata Hydrogeological significance Anticipated Aquifer Potential

<table>
<thead>
<tr>
<th>Strata</th>
<th>Hydrogeological significance</th>
<th>Aquifer Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made Ground</td>
<td>Variable material that may contain some perched water</td>
<td>Variable</td>
</tr>
<tr>
<td>Langley Silt Member</td>
<td>Langley Silt Member is an aquitard and therefore will not contain significantly large quantities of groundwater.</td>
<td>Unproductive Stratum</td>
</tr>
<tr>
<td>Terrace Gravel</td>
<td>Has potential to transmit significant quantities of water. Due to impermeable clay below it is likely to contain perched groundwater.</td>
<td>Secondary (A)</td>
</tr>
<tr>
<td>London Clay</td>
<td>The London Clay is an aquitard and therefore will not contain significantly large quantities of groundwater.</td>
<td>Unproductive Stratum</td>
</tr>
<tr>
<td>Lambeth Group</td>
<td>The Lambeth Group is unlikely to contain significantly large quantities of groundwater, however the lower part of the stratum where the material has less clay content may be in hydraulic continuity with the lower layers</td>
<td>Unproductive Stratum</td>
</tr>
<tr>
<td>Thanet sands</td>
<td>This strata is highly permeable and is often in hydraulic continuity with the underlying Chalk</td>
<td>Principle Aquifer</td>
</tr>
<tr>
<td>Chalk</td>
<td>Chalk strata contains large quantities of water and is often used for water abstraction</td>
<td>Principle Aquifer</td>
</tr>
</tbody>
</table>

Table 3: Summary of Environment Agency classification and anticipated aquifer.
3.6.4
Flood risk

The Envirocheck flood map in Figure 37 indicates that the site is located in Flood Zone 1, an area which is considered to have a low risk of flooding. Flood Zone 1 is defined in the National Planning Policy Framework (NPPF) as land being assessed to have an annual probability of fluvial and coastal floods occurring of less than 0.1% (1 in 1000). This notwithstanding, a flood risk assessment has been completed for BREEAM purposes.

It must be ensured that the proposed development does not increase the risk of flooding to adjacent or downstream properties.
3.7 Site constraints

3.7.1 Statutory Searches

AKT II instructed Envirocheck to carry out a search of available records and report on the following aspects:

**Water:**
- Abstractions and discharge consents
- Red list discharge consents
- Pollution incidents and prosecutions relating to controlled waters
- Groundwater vulnerability and river quality

**Waste:**
- Landfill sites (historical and current)
- Waste water treatment or disposal and transfer sites
- IPC registered waste sites

**Statutory controls:**
- Integrated pollution and air pollution controls
- Prosecutions relating to authorised processes
- Enforcement and probation notices
- Planning hazardous substance consents and enforcements
- CDMAH, NIMHS and explosive sites

The following is a factual summary of the information obtained from the Envirocheck search:

- A Discharge Consent was found located 555m north west of the site from a reservoir/borehole site of type 'Trade Effluent'.
- The status of the consent is 'authorisation revoked'. Two other discharge consents were found within 1km of the site in the same location from a sewerage network.
- Four Local Authority Pollution Prevention and Controls (IPPCs) were found located within 250m of the site. A further twelve IPPC were found located within 1km of the site. All sites are associated with either dry cleaning, petrol filling stations or a plastic and metal coating unit. The closest is located 220m east of the site adjacent to the post office.
- The Nearest Surface Water Feature is within 470m of the site to the north west.
- One Pollution Incident to Controlled Waters was found located 232m south west of the site. One other was found within 1km of the site.
- Eleven Registered Radioactive Substances were found located between 500 and 620m of the site. One other was found within 1km of the site.
- Ten Water Abstractions were found located within 1,410m to 2km of the site.
- The site was found to have Groundwater Vulnerability with soils of high leaching potential. A worst case vulnerability classification (H) assumed, until proved otherwise.
- There are no current or former landfill sites, within a 500m radius of the site. A Licensed Waste Management Facility was found located 473m north east of the site at 125 Kensigton High Street.
- Four fuel station entries were found located within 600m of the site. The closest is located 530m south east of the site.
- A number of contemporary trade directory entries were found in close vicinity to the site including dry cleaners, manufacturers, photographic processors, car dealers all located within 2.0km of the site.
- The Envirocheck report also recorded the geotechnical hazards in the vicinity of the site, which is summarised in Table 2.
- The site is not in a radon affected area, as less than 1% of the homes are above the action level. BRE document 211: Radon, Guidance on Protective Measure for New Dwellings 1999
- The site does not lie within a nitrate vulnerable zone defined by the Department for Environment, Food and Rural Affairs (DEFRA).
- The site is not located within an Environment Agency designated source protection zone (SPZ).

3.7.2 Utilities & Services

Utilities and services in the proximity of the site have been located based on a Landmark Envirocheck report for the site and immediate surroundings. Based on this it has been established that UK Power Networks (UKPN), National Grid Gas (NGG), Thames Water and numerous data installations are present around the site, though none cross it. The relevant bodies will be contacted, and additional investigations undertaken where necessary to establish exact positions during the detailed design phase.

Utilities associated with the sites use as a cinema will be present on site. It is planned that prior to demolition and construction trial trenches are used to confirm ‘as built’ information to reduce any risks of unrecorded obstructions.

3.7.3 Thames Water installations

Below both Earls Court Rd and Kensington High St there are 640mm to 1800mm water mains present.

Additionally, beneath Kensington High St, record drawings indicate the presence of a 350mm trunk main and a 1200mm x 800m foul sewer. The proposed basement appears to sit beyond the likely exclusion zone, however this will be confirmed by survey and the necessary approvals agreed with Thames Water. Refer to section 5.6 for further details of the proposed approach.

In line with the current arrangements for the site it is proposed that the below ground drainage for the new buildings discharges into the local Thames Water network. A CCTV of the existing drainage network has been undertaken to establish the precise details and condition of the network and this information will be used to complete the design and obtain the necessary approvals.

3.7.4 Underground structures

The existing basement is at an approximate level of 5.0mOD. Given the previous site uses, it is possible that there will be unknown buried foundations or structures. The most likely source of these is from the townhouses demolished when the cinema was first constructed.

There are no other foreseeable underground structures present on the site.

3.7.5 Unexploded Ordnance

Many bombs that were dropped during the Second World War blitz did not explode on impact. Some are far more problematic as they are non ferrous, and so require more sophisticated and expensive detection techniques. Bomb detonators don’t deteriorate and the explosives do not become inert with time.

If unexploded bombs were still present on site they would consequently present a health and safety risk and also a contamination risk.

The ministry of defence has published maps indicating the extent of damage to buildings during the raids and in Central London, which is displayed in Figure 24. It indicates that the site wasn’t damaged during the First and Second World War, although alternative record information suggests minor damage was sustained in 1944. A V2 long range rocket is indicated as landing within 100m distance to the north east of the site.

Buildings surrounding the location of landing were damaged.
to a level beyond repair. Minor blast damage was incurred to buildings within a few hundred metres vicinity. Although the bomb damage map indicates the cinema as not having been damaged, other sources suggest it was closed for a period to repair light bomb damage.

Allied and German records stated that 10% of all bombs and 35% of incendiary devices did not explode and lie buried in the ground. However, relatively few of these remain undiscovered. German V1 and V2 bombs offer a low risk.

Bombs may also travel laterally after impact depending on the geology of the site and other factors. Generally, bombs in London have penetrated between 6 and 10m in the local geology with a lateral offset of 2 to 3 m (actually one third of the penetration depth).

Bombs during the wars were also responsible for heavy pollution as they broke several pipes and conduits when exploding. For example, the groundwater was highly contaminated during this period.

The list of unexploded buried bombs in London that was published by the Ministry of Defence recently showed a UXB to be 390m away at the front of 72/74 Warwick Gardens. The next nearest UXB is 2km away from the site.

### 3.7.6 Trees

There are two London Plane trees on the northern boundary of the site which will be retained as part of the development. The proposed basement wall has been set-out based on the recommendations of the aboriculturalist to prevent damage to the trees. Temporary protection measures in accordance with their recommendations will also be implemented by the contractor during the construction phase.

Around the perimeter to the south and west, inside the gardens of Edwardes Square and Pembroke Place, a pair of mature trees exist. Investigations were undertaken in May 2014 to determine the extent of the root ball within the Kensington site. Based on this it was determined that there is no significant presence of roots and therefore the proposed basement could be constructed without detrimental impact. Refer to the DPA report for further detail.

### 3.7.7 Underground tunnels

The London Underground Limited (LUL) District and Circle line run at approximately 500m distance from the site in two locations.

There are no post office tunnels running in the vicinity of the site.
3.8 Adjacent buildings

Eastern Boundary
On the northeastern corner is 255 Kensington High St, which based on record information has a single basement with four storeys above ground. It is assumed to be load bearing masonry construction with shallow strip footings.

To the south of Whitlock House is 12-14 Earls Court Rd, which comprises three storeys of residential above ground floor retail. Based on record drawings and visual similarities in the rear elevation it is likely that this building was constructed together with Whitlock House and would therefore likely share the same reinforced concrete frame construction and possible piled foundations.

Southern Boundary
Numbers 27 to 32 Pembroke place sit directly adjacent to the southern site boundary, whilst numbers 1,4, 5 and 32a sit on the other side of the Pembroke Place access but are in close proximity to the site. These buildings are 2-3 storey Victorian terrace houses and therefore most likely to be load bearing masonry construction with shallow strip footings.

Western Boundary
267 Kensington High St (Leonard Court) constructed circa 1950 is residential building rising five storeys above ground with a single story basement. It is assumed to be a load bearing masonry structure, which is consistent with the findings of the site investigation that found corbel footings sitting on concrete strip footings.

To the south of Leonard Court runs the rear wall of the Edwardes Square dwellings gardens. This is defined by a masonry wall on shallow strip footings which has been extended vertically and/or incorporated into single storey buildings on the other side of the wall.

**Images:**
- 255 Kensington High St, north west corner
- 12-14 Earls Court Rd, east elevation
- 27-32 Pembroke Place, south elevation
- Garden wall to the rear of Edwardes Square houses, with south elevation of Leonard Court beyond
4.0 Proposed Alterations

4.1 Overview

The proposed development comprises a mixture of uses spread across different blocks above ground:

- Block 1, eight storeys above ground, private residential incorporating the cinema entrance
- Block 2, five storeys, private residential
- Block 3, six storeys residential, over ground floor retail
- Block 4, four storeys, office
- Block 5, three storeys, residential
- Townhouses 1-6, four storeys, private residential
- Townhouses 7-8, three storeys, private residential

It is proposed that the buildings are grouped into six superstructures above the combined basement box, each with their own framing system and lateral stability system: This division is denoted by the colour-coding in the figure below.

4.2 Existing structure

With the exception of the Odeon facade, the existing structures on the site will be demolished.

4.3 Superstructure

The superstructure of all buildings will be in-situ reinforced concrete construction. Lateral stability will be provided by shear walls and, where required, augmented by frame action. A limited number of steel elements, e.g. transfer beams will be utilised where dictated by design constraints.
4.4
Retained facade

Due to its historical significance and architectural merit, it is proposed to retain the existing facade of the Odeon Kensington. It is not listed.

At this stage retention proposals have been based on limited architectural archive drawings obtained from the Metropolitan Archive and the Paye appraisal (refer to appendix). These assumptions will need to be confirmed and augmented by a detailed structural fabric survey, to facilitate the development of detailed proposals.

It is anticipated that the facade comprises a load bearing steel frame clad with a pre-cast concrete ashlar blocks and masonry. This is likely to have been notched to fit around the steel members with the mortar assumed to have provided an adhesive bond as well as corrosion and fire protection to the steel. In practice this type of cladding proved to be permeable and the any resultant expansion due to corrosion of the underlying steel typically leads to cracking of the surrounding masonry (commonly known as Regent St disease). The use of impressed current cathodic protection (ICCP) should retard any further corrosion of the steel if present, whilst the damaged masonry may be treated with a mixture of repair and sensitive replacement.

With respect to the structural system it is proposed that the vertical load bearing system of the facade is maintained on existing footings, however it is assumed that the building behind the facade provides lateral support and therefore once this is demolished an alternative system is required. In the temporary condition (construction phase), it is proposed to install a steel support frame outside the north elevation as this is a proven solution for this type of facade. Specific to The Kensington, this temporary frame will be designed and installed so that there is no detrimental impact on the two London Plane trees on Kensington High St. In the permanent condition a connection will be formed with the new concrete frame such that lateral forces are transferred into the new lateral stability system, whilst vertical load paths and movements remain separate.