This is an extract of the full report which was submitted as part of Cranbrooks Documents to the Inspector reference - Document 3 - Arup Geotechnics - RBKC Town Planning Policy on Subterranean Development

ArupGeotechnics

Royal Borough of Kensington & Chelsea

RBKC Town Planning Policy on Subterranean Development

Phase 1 - Scoping Study
DRAFT

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5 Discussion of the main effects of basements

5.1 Underground water

In the City of London (the Square Mile), the natural, near-surface geology is very similar to that present under much of the Royal Borough of Kensington and Chelsea, with River Terrace Deposits overlying London Clay. In and around the City, the pressure on available real estate has meant that the installation of large basements has been the norm since the post-war period. Even earlier than this, most bank buildings had basements as this offered greater security for vaults and storage. Across swathes of the City, the basements of adjoining buildings touch their neighbours such that there is little or no soil left in the ground down to the depth of the basements, which typically extend as deep as the upper part of the London Clay. In such areas, the only remaining shallow, permeable soil exists underneath the roadways.

The large-scale removal of the River Terrace Deposits (the gravelly, water-permeable soils that overlie the relatively impermeable London Clay; Section 3.2.1) from the City has not caused significant problems associated with localised "damming" in the shallow groundwater table. The groundwater, where it is present and if it is moving, simply finds another route if it becomes "blocked" by a subterranean structure at a particular location, although there may be local rises in level. In the City, this alternate route for groundwater flow is under the roads. Where the groundwater in the Upper Aquifer is indeed moving – rather than being a static puddle – the flow rates tend to be slow and modest. The urbanisation of London has significantly altered ground water levels in the Upper Aquifer and the natural trends and directions of flow within this aquifer. For example, the construction of Joseph Bazalgette's intercept sewers along the embankments of the Thames; and, locally in the Borough, the corralling of the Westbourne and Counter's Creek into sewers; the sealing-off to rainfall of the ground surface by pavements and buildings; and leakage from water mains and sewers have all acted to alter groundwater levels and flow regimes.

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Within the upper surface of the London Clay, localised ancient river channels are sometimes encountered. These exist as incised grooves in the upper surface of the clay layer, and are typically infilled with relatively permeable River Terrace Deposit material. Groundwater tends to accumulate in these features, because they act as low-lying sumps. The water in a buried channel may or may not flow, depending on whether the channel connects with other such features. If it does flow, the flow rate is likely to be slow. If an incised channel of this type is encountered during subterranean development works, it could present particular challenges for a contractor who is building a basement using the underpinning method. This is because it would be more difficult to excavate safely the soil at each underpin (significant pumping would be needed), and because the surface of the London Clay would be locally deeper than may have been anticipated at the design stage, unless the ground investigation for the project included exploratory boreholes that intersected the channel. Once the basement sidewalls had been formed across the channel, forming a seal or obstruction, the groundwater within the soil in the channel would cease to flow (if it had indeed flowed previously) in that direction, and another preferential flow route elsewhere in the ground would take over.

If mobile groundwater in the Upper Aquifer were forced to find an alternative flow route past an underground obstruction, that could potentially cause the groundwater level within the zone encompassed by the new flow route to increase locally. For an existing cellar within that zone, if the cellar was not suitably protected ("tanked") against groundwater ingress, then the degree of dampness or seepage into the basement may potentially increase. For natural springs[2], of which there are several recorded in the Borough, the rate of water flow from the spring may increase. The level of the water table within the Upper Aquifer varies and is not naturally static: variations in the water table are mainly associated with seasonal changes in rainfall and in plant transpiration rates (water uptake by plants) as well as extreme weather events, and other factors such as pipe bursts and sewer leakage. Any assessment of potential changes in ground water level that may be associated with a specific subterranean development should therefore be viewed in the context of the local ambient variations. It is likely that a cellar or spring may already have experienced greater groundwater levels on frequent occasions in the past.

Given the importance of groundwater to the wellbeing of trees, it is informative to consider a situation in which every property around the four sides of a garden square on the River Terrace Deposits has a basement that extends as deep as the top of the London Clay, and that all the properties are terraced. That would mean that the only remaining underground routes for groundwater to flow into the garden square would be the “fingers” of gravelly soil that remained under the roads leading into the square. Would this have an adverse impact on the trees? Rainwater would still fall onto the ground surface, which, being grassed rather than paved, should allow the rainwater to percolate into the soil. In periods of low rainfall, trees rely more heavily on water stored within the Upper Aquifer. The fingers of soil that remain under the roads would allow this aquifer to be gradually recharged with groundwater from outside the square, and this would be augmented by any leaks from pipes and sewers within the square. It is important to recognise that the situation of the terraced square on the River Terrace Deposits is arguably better than that of any garden on the London Clay. For gardens on the London Clay, such as those in the north of the Borough, the Upper Aquifer is absent and therefore trees and plants must rely on moisture within the clay. This soil moisture can only be recharged by infiltration by rainfall, irrigation or subsurface leaks from mains and sewers.

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It is understood that, within the Borough, it has been suggested that it may be useful to require subterranean developers to leave a buffer of soil between adjacent basements, in order to enable groundwater to flow around and between individual basements. As described above, this provision is unlikely to be necessary, as the groundwater in the Upper Aquifer can tend to find an alternate route, even under obstructions as large as entire city “blocks”. Moreover, the provision of a soil buffer between a pair of basement walls on either side of a party wall is likely to increase the structural difficulty of, and hence the risks associated with, supporting the party wall.

5.2 Surrounding buildings

This section considers the potential effects of subterranean developments on nearby structures and infrastructure. In the extreme case, a building may directly adjoin another structure and the two properties may share a common party wall. In other situations, the neighbouring structures may not abut the building of interest, but may still lie within the potential halo of influence of subterranean development works at that building.

Before the works: pre-condition surveys

The following sub-sections describe various situations in which, if they are not successfully avoided by the appropriate planning, design and execution of subterranean development works, could potentially cause damage to neighbouring structures. Such damage could include cracking, or perhaps more severe structural damage. In practice, it is often difficult to attribute cracks visible in a structure to specific site construction activities unless a detailed survey of the affected structure had been undertaken before the construction works

[2] A spring is a geological feature formed where the interface between a permeable soil, such as gravel, overlying an impermeable soil, such as clay, intersects a hillside, and where groundwater in the permeable soil flows out at the ground surface.

7 Conclusions of Phase 1 scoping study

This report has presented the results of the Phase 1 scoping study undertaken by Arup on behalf of the Royal Borough of Kensington and Chelsea. The aims of the scoping study are to identify and assess the likely importance of factors and issues considered to be potentially relevant to planning policies for subterranean development in the Borough. Given that the current Unitary Development Plan (UDP) is soon to be replaced by the new Local Development Framework (LDF), the scoping study has looked ahead to how subterranean development could be addressed within the LDF.

The following points summarise the key conclusions of the scoping study:

1. Subterranean development in the Borough cannot be viewed in isolation from other planning issues, including for example: the protection of heritage structures, archaeology, and conservation areas; environmental protection; requirements for sustainable development; the need for provision of additional housing; the risk of flooding *etc*. The present UDP includes several planning policies which, although not explicitly concerned with subterranean development, impinge upon it indirectly (Section 6.1).

2. Clause CD32 of the UDP (2002, page 68) deals explicitly with subterranean development in the Borough. The provisions of CD32 encompass: the effect on the amenity of neighbouring properties; landscaping and adequacy of reinstated soil depth; loss of open space; loss of trees; loss of important archaeological remains; and the structural stability of buildings, but only within conservation areas. Assuming that these or similar general provisions are carried forward to the new LDF in some format, it is appropriate to note that Clause CD32(c) in the UDP relates to the structural stability of buildings in conservation areas only. In the Borough, the conservation areas cover almost 70% of the total land area, and so Clause CD32(c) includes many if not most properties in the Borough. However, it is unclear why structural stability only within the conservation areas is explicitly covered, because occupants as well as buildings could be put at potential risk if a major collapse were ever to occur during subterranean development works.

3. The public consultation process on subterranean development in the Borough undertaken during this scoping study indicated that the potential impact of subterranean developments on groundwater levels and groundwater flows is a subject of concern for many people. The scale and extent of such impacts will be site-specific, and will depend very much on a combination of local, site-specific factors acting together such soil types, underground topography (the shapes of the interfaces between different soil layers) and the existing pattern of ground water flows within the local area. In general, where the sub-surface conditions are not unusually adverse, flowing groundwater will usually simply find an alternative route when it meets an underground obstruction, and static groundwater will re-distribute itself. It is therefore likely that, in general, the effect of a new basement on groundwater levels will be relatively small, and may be less significant than natural seasonal or other variations in the groundwater table. Both groundwater levels and groundwater flows are factors that competent basement design engineers and contractors should take into account in their work, as each affects the technical design and practical construction of a basement.

4. Concerns about the potential for structural damage if subterranean development works are not undertaken properly were also prominent in the public consulation undertaken during this scoping study. Subterranean development in a dense urban environment, especially basements built under existing structures, is a significantly more challenging