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For the attention of Ms Rachel Betts

Geotechnical Department

Our ref: 351221

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Dear Rachel,

RE: MAITLAND PARK, CAMDEN – REVIEW OF EXISTING CONTAMINATED LAND ASSESSMENTS

CET Infrastructure (CET) was instructed by Price and Myers LLP (P&M) to carry out a review of existing site investigation and risk assessment reports relating to the Maitland Park study site located at Maitland Villas, Camden, London NW3 2HG.

It is understood that the site currently comprises residential apartments, a gym building, garages, car parking, access and communal soft landscaped areas. It is further understood that the site is to be redeveloped into three four and five storey residential apartment blocks with associated access and communal landscaped areas.

Several reports have been supplied for review by CET. The following includes only those reports that comment on the potential contaminated land issues and therefore any purely geotechnical reports have been excluded from the review.

GEOTECHNICAL AND ENVIRONMENTAL DESK STUDY (RAMBOLL, JANUARY 2013)

The first supplied Ramboll report concerning land contamination comprised a desk study that established the following regarding the site and its environmental setting:

- The study site comprises an irregular shaped plot of land to the east and west of Maitland Villas and covers an area of approximately 1.23Ha. The site is centred at National Grid reference TQ 279 849.

- Historically the site comprised residential dwellings, parkland and a school. Two electrical substations were constructed during the 1950s and 1970s to the south of the study site. The surrounding area was predominantly remained residential throughout the mapping period.
- The site is underlain by the London Clay Formation, which was classified as Unproductive Strata by the Environment Agency. No superficial deposits are mapped at the site, however historical borehole logs at the site indicate the presence of possible Made Ground and Head overlying the London Clay Formation.
- The site is not located within a groundwater Source Protection Zone (SPZ) and no water abstractions are recorded within 250m of the study site. The nearest surface water feature is the River Fleet, a tributary of the River Thames, which flows underground and forms part of the London sewer system some 150m north east of the site.
- No authorised or historical landfill sites are recorded within 1km of the study site. Three local authority pollution and prevention controls were recorded within 250m of the site, relating to dry cleaners some 100m south, 120m north and 230m east. In addition to the dry cleaners several trade activities were recorded in the vicinity of the site, these included a laundry, MOT testing station, scaffold suppliers, pharmacy, hardware store, car dealers and an ice cream manufacturer.
- The closest sensitive land use is Belsize Wood situated approximately 400m north west of the site.
- The BGS national soil mapping project indicates there is the potential for arsenic and lead in excess of the appropriate residential standards (excluding home grown produce).

The Ramboll report then went on to discuss the contaminated land risks. Firstly the presence of two historical substations on site was considered to represent a source of poly chlorinated bipenyls (PCBs) and hydrocarbons. Secondly the historical foundations and demolition rubble associated with the buildings previously on site could be encountered during the construction works and could contain asbestos due to the age of the material. No current on site or off site land uses were identified by Ramboll that were considered to represent a significant source of contamination. However, the report indicated that some on site garages are to be demolished and hydrocarbons may be present within any adjacent drains. Finally, it was judged that there was the potential of elevated concentrations of lead and arsenic that could be mobilised by infiltration of water and migrate through the Made Ground and any superficial deposits.

Based on the historical on site land uses and off site current and historical uses identified by the Ramboll assessment they considered that there was generally a low to moderate risk of the study site being impacted by a range of contaminants including PCBs, hydrocarbons, asbestos, lead and arsenic. It was concluded that such contamination could have the potential to pose a risk to human receptors.

Ramboll recommended that a combined geotechnical and contaminated land ground investigation should be undertaken comprising the formation of cable percussion boreholes and the installation of gas and groundwater monitoring wells.

CONTAMINATED LAND LETTER REPORT (RAMBOLL, MAY 2014)

In order to more accurately assess the risk posed to human health a limited intrusive ground investigation was undertaken by Ramboll. The site investigation comprised the formation of three cable percussive boreholes, BH1, BH3 and BH6, to depths of between 25m and 35m below ground level (bgl). In addition BH1 and BH6 were installed with gas and groundwater monitoring wells.

Made Ground was found to be present in all locations to a maximum depth of 2.0m bgl. The Made Ground was described as granular material with fragments of asphalt, wood and metal. The gravels comprised brick, chalk, flint, wood, metal, asphalt, concrete and tile. Directly beneath the Made Ground was firm to stiff clay, identified as the London Clay Formation. No superficial deposits or groundwater were encountered during the investigation.

Five samples were recovered for testing, three from the Made Ground at 0.5m and two from BH1 and BH3 at 1.5m bgl in the underlying natural soils. The results were compared to the available Soil Guideline Values (SGVs) and PAHs, lead and vanadium were found to exceed the screening criteria that considered a residential with gardens end use. Vanadium was slightly elevated in both the Made Ground and underlying natural soils. Concentrations of hydrocarbons exceeded the UKWIR threshold values for plastic water supply pipes in BH3, however the elevated TPH and PAHs were attributed to the presence of asphalt in the Made Ground. The asphalt was considered unlikely to pose a significant risk of permutation to the water supply pipes due to its limited leachability.

Groundwater samples were recovered from the monitoring wells and analysed for a range of contaminants. The concentrations of the determinands were low and were not considered to pose a significant risk to the water environment.

Soil gas monitoring was undertaken during March and April 2014. The barometric pressure ranged between 1002 and 1016mb. The maximum concentrations of methane and carbon dioxide were 0.1% and 1.7% respectively and the maximum flow was 0.1l/h. Depleted oxygen was not encountered. A Characteristic Situation of CS1 was calculated from the gas data and as a result no specific ground gas protection measures were recommended by Ramboll.

The updated conceptual site model recorded moderate risks from ground gas, which may require mitigation measures according to Ramboll. Risks to end users, ground workers and buried services were assessed as moderate from the presence of elevated concentrations of heavy metals, PAHs and TPH. The risks to end users and groundworkers from elevated concentrations of vanadium were also assessed as moderate.

It should be noted that in the report Ramboll used the SGVs as screening values, these have now been superseded and therefore the established assessment criteria are not deemed to be suitable for use in the current regulatory context. The following section comprises an updated generic risk assessment using the data from the Ramboll report.

Supplementary Generic Risk Assessment

In order to ascertain the significance of the results in a current regulatory context data was extracted from the Ramboll report was subjected to a Generic Risk Assessment. Based on the proposed end use of the study site the initial screen of the chemical data was made against available Suitable 4 Use Levels (S4ULs) and Category 4 Screening Levels (C4SLs). For the purposes of this assessment S4ULs selected to perform an initial screen of the chemical data reflected a 'residential end use without home grown produce' (RwoHP). In this instance the most sensitive potential receptor is judged to be a female child between the age of 0 and 6 years. The consumption of contaminants via home grown fruit and vegetables has not been considered as an applicable pathway.

A comparison of the metals recorded by the analysis with the corresponding generic screening criteria is presented in the following table:

Contaminant	Samples		S4UL* (RwoHP)	
	Maximum Conc. (mg/kg)	Location	S4UL (mg/kg)	No. Samples exceeding assessment criteria
Arsenic	14	BH1 @ 0.5m	40	0
Cadmium	0.3	BH3 @ 0.5m	85	0
Chromium III	50	BH1/BH3 @ 1.5m	910	0
Mercury	<0.3	N/A	56	0
Lead [#]	460	BH3 @ 0.5m	310	1
Nickel	44	BH3 @ 1.5m	180	0
Copper	45	BH3 @ 0.5m	7100	0
Selenium	<1.0	N/A	430	0
Vanadium	88	BH6 @ 0.5m/ BH3 @ 1.5m	1200	0
Zinc	110	BH3 @ 0.5m	40 000	0
Notes to Table				
*	<i>Most appropriate supplied S4ULs are based on a 'residential without home grown produce' end use, a sandy loam soil type, pH of 7 and a soil organic matter (SOM) of 6%.</i>			
#	<i>Category 4 Screening Level (2014) used in absence of suitable S4UL.</i>			

As the above table indicates, with the exception of lead in sample BH3 at 0.5m, the concentrations of metals recorded by the analysis did not exceed the respective threshold criteria. However, one concentration of lead in the Made Ground was recorded in excess of the corresponding S4UL and is therefore judged to have the potential to pose a significant risk to future site users via the direct contact, ingestion and dust inhalation exposure pathways.

Asbestos was not detected in any of the samples screened by the laboratory.

A summary of the PAH compounds recorded by the analysis is included in the following table:

Contaminant	Samples		S4UL* (RwoHP)	
	Maximum Conc. (mg/kg)	Location	S4UL (mg/kg)	No. Samples exceeding assessment criteria
Naphthalene	1.5	BH3 @ 0.5m	2.3	0
Acenaphthylene	4.5	BH3 @ 0.5m	2900	0
Acenaphthene	8.8	BH3 @ 0.5m	3000	0
Fluorene	7.6	BH3 @ 0.5m	2800	0
Phenanthrene	110	BH3 @ 0.5m	1300	0
Anthracene	27	BH3 @ 0.5m	31 000	0
Fluoranthene	180	BH3 @ 0.5m	1500	0
Pyrene	160	BH3 @ 0.5m	3700	0
B(a)A	77	BH3 @ 0.5m	11	1
Chrysene	70	BH3 @ 0.5m	30	1
B(b)F	97	BH3 @ 0.5m	3.9	1
B(k)F	30	BH3 @ 0.5m	110	0
B(a)P	69	BH3 @ 0.5m	3.2	2
I(123-cd)P	36	BH3 @ 0.5m	45	0
D(ah)A	11	BH3 @ 0.5m	0.31	2
B(ghi)P	41	BH3 @ 0.5m	360	0
Notes to Table				
*	<i>Most appropriate supplied S4ULs are based on a 'residential without home grown produce' end use, a sandy loam soil type, pH of 7 and a soil organic matter (SOM) of 1%.</i>			

As the above table indicates, potentially significant concentrations in excess of the corresponding S4ULs were detected in the two samples of Made Ground recovered from BH1 and BH3 at 0.5m. Reference to the corresponding exploratory hole log identifies the tested soils to contain fragments of asphalt, which is known to represent a potential source of PAH contamination.

A summary of the recorded concentrations of petroleum hydrocarbons is provided in the following table:

Contaminant	Samples		S4UL* (RwoHP)	
	Maximum Conc. (mg/kg)	Location	S4UL (mg/kg)	No. Samples exceeding assessment criteria
TPH C10-C12 aro	2.5	BH3 @ 0.5m	250	0
TPH C12-C16 ali	12	BH3 @ 0.5m	1100	0
TPH C12-C16 aro	110	BH3 @ 0.5m	1800	0
TPH C16-C35 ali	152	BH3 @ 0.5m	65 000	0
TPH C16-C21 aro	790	BH3 @ 0.5m	1900	0
TPH C21-C35 aro	1200	BH3 @ 0.5m	1900	0
<i>Notes to Table</i>				
*	<i>Most appropriate supplied S4ULs are based on a 'residential without home grown produce' end use, a sandy loam soil type, pH of 7 and a soil organic matter (SOM) of 1%.</i>			

As the above table demonstrates, none of the petroleum hydrocarbon compounds detected by the analysis exceeded the corresponding S4ULs and as such it is considered that they are likely to pose a negligible risk to human receptors.

The concentrations of determinands in the groundwater were generally found to be below the limit of detection and where present were below the relevant respective generic screening criteria including the Environmental Quality Standards and the UK Drinking Water Standards.

The Ramboll report concluded that potential sources of ground contamination identified at the site include vanadium in the natural soils and heavy metals and PAHs in the Made Ground. In addition the recorded concentrations of TPH could impact buried water supply pipes. The report recommended that further investigation would be required due to the three locations that were cancelled as a result of access issues and the investigation should also target the electrical substation. In addition the risks would only be present where the impacted soils are not covered by buildings, hard surfacing or clean topsoil when the works are completed.

SUMMARY & CONCLUSIONS

CET concur that based upon the findings of the supplied reports it is considered that further sampling at the study site is required to increase the dataset and gain a better understanding of the spatial extent of the identified contamination with respect to human health. It is recommended the future investigation works should focus on the Made Ground and shallow soils that future site users and construction workers are most likely to come into contact with.

Based on the contamination source map produced by Ramboll it appears that there is one electricity substation located on the southern boundary of study site. It is recommended that the substation is visually inspected to look for obvious signs of a leak, such as oily staining or vegetation die back. In addition at least one on site exploratory hole should be located as close to the substation as possible so that samples can be recovered for environmental testing.

As the site is underlain by the London Clay Formation, Ramboll did not identify any sensitive water receptors within the vicinity of the site and no significant concentrations of determinands were recorded in the samples tested to date it is considered the risks to controlled waters are negligible. Furthermore, it is unlikely that any further testing will be required.

It is not understood why Ramboll considered there to be a moderate risk from ground gases based on the results to date. The site has been classified as a Characteristic Situation 1 by Ramboll, for which no specific ground gas protection measures are considered necessary. In order to fully resolve the risks from ground gas it may be prudent to undertake one further round of monitoring is undertaken during a period of low pressure (<1000mb) in line with current best practice.

Further to the above, CET have been commissioned to undertake a further phase of ground investigation comprising seven hand dug trial pits and five window sampler boreholes. An experienced geoenvironmental engineer will be overseeing the works to inspect, log and recover samples for environmental testing. The exact suite of testing will include the determinands from the previous reports and be tailored to any pertinent observations made during the site works. During the works the existing monitoring wells will be located to confirm they are serviceable. A risk assessment will be undertaken within the current regulatory framework and will include an update conceptual site model with appropriate source-pathway-receptor linkages. If significant contamination is identified than a remediation plan will be devised and agreed with the Local Authority. Any subsequent remediation will be subject to appropriate validation and verification.

We trust that the above meets your requirements. However, please do not hesitate to contact us with any additional questions or queries.

Kind regards,



Catherine Tame BSc MSc MIEEnvSc
Senior Environmental Scientist
For and on behalf of CET Infrastructure