



Appendix 11.1

2018 VERIFICATION REPORT

THFC Stadium and Hotel
Verification Report

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1 Introduction

1.1 Report scope and objectives

This report has been prepared by BuroHappold Engineering on behalf of Tottenham Hotspur Property Co Limited to provide appropriate evidence of the successful completion of the remediation strategy relevant to the Northumberland Park Development Project in Tottenham, London which includes the new Tottenham Hotspur Stadium and hotel site. This report, therefore, presents the information necessary to satisfy the final elements of the contamination related planning conditions (see below). The particular objectives of this report are to: (i) describe the verification activities that have been carried out; (ii) present supporting information on the remedial measures undertaken to mitigate the risks identified in the previous investigations and; (iii) describe the presence and remediation of any unforeseen contamination encountered during the construction works.

1.2 Relevant planning conditions

This report has been prepared to address the requirements of London Borough of Haringey with respect to land affected by contamination, set out in the planning permission for the Northumberland Park Development Project granted on 20th September 2011 [Ref: HGY/2010/1000]. The relevant conditions are presented below:

37. Unless otherwise agreed in writing by the Local Planning Authority, within each part of the site, as specified in the agreed S106 phasing plan, no development shall commence in that part of the site until a Ground Contamination, Soil Remediation and Disposal Strategy supported by site history has been submitted to and approved in writing by the Local Planning Authority.

58. Prior to commencement of development approved by this planning permission (or such other date or stage in development as may be agreed in writing with the Local Planning Authority), the following components of a scheme to deal with the risks associated with contamination of the site shall be submitted to and approved, in writing, by the local planning authority:

- 1. A preliminary risk assessment which has identified:*
 - a. All previous uses*
 - b. Potential contaminants associated with those uses*
 - c. A conceptual model of the site indicating sources, pathways and receptors*
 - d. Potentially unacceptable risks arising from contamination at the site*
- 2. A site investigation scheme, based on (1) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.*
- 3. The site investigation results and detailed risk assessment (2) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.*
- 4. A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in (3) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action.*

59. If, during development, contamination not previously identified is found to be present at the site then no further development (unless agreed in writing with the Local Planning Authority) shall be carried out until the developer has submitted, and obtained written approval from the Local Planning Authority for, an amendment to the remediation strategy detailing how this unsuspected contamination shall be dealt with.

In order to enable the full discharge of conditions 37, 58 and 59 a verification report is required that demonstrates how the risks from contamination have been mitigated.

The reports and other correspondence that addressed the assessment and design parts of these Conditions are briefly discussed in Section 2 of this report. The description of the verification activities that demonstrate remediation in accordance with the approved Strategy is presented in Sections 3, 4 and 5 of this report, together with the supporting drawings and detailed information in the various appendices.

1.3 Responsibilities of parties

The team responsible for the construction of the Tottenham Hotspur Stadium comprised Tottenham Hotspur Football Club (the Client and Project Managers), Arcadis (the cost consultant) with the structural design undertaken by BuroHappold Engineering. The main contractor for the site is Mace who have overall responsibility for the construction works. The majority of the earthworks were undertaken by Ryebribe Construction during an enabling works phase (prior to appointment of the main contractor), however upon appointment of the main contractor DSM were responsible for earthworks. BuroHappold were responsible for the preparation of this Verification Report.

2 Background to the project

2.1 Site location, history and description

The development site is located in Tottenham, within the London Borough of Haringey, North London. The approximate Ordnance Survey National Grid Reference for the centre of the site is 534010, 191270. The site occupies some 8 ha, its location is shown in Figure 2-1 below. The Site redline boundary for the discharge of the relevant planning conditions as detailed in Section 1.2 above is provided in Figure 2-2.

Figure 2-1 - Site Location



Figure 2-2 – Redline boundary



The site was occupied by orchards and open space from at least 1867. By 1896 the majority of the orchards had been cleared, and buildings constructed along Tottenham High Road. Paxton Road had also been constructed at this time. By 1913, Tottenham Hotspur Football Stadium had been built along with terraced housing fronting Paxton Road to the north and east of the stadium. A number of buildings were also present to the west of the stadium. A brewery and allotment gardens were present to the north of Paxton Road by 1935 along with a mechanical engineering and manufactory to the south-west of the stadium and the terraced housing to the east of the stadium had been demolished. Post war, the site was occupied by various commercial/industrial land uses including, but not limited to, engineering works, bottling stores, garages, piano works, small industrial units, shoe factory, milk depot and warehouses.

Prior to commencement of the redevelopment, the site was occupied by White Hart Lane football stadium to the south and to the north and centre by: a sheet metal works, a place of worship and a large area of hardstanding used for additional car parking for the stadium. Vacant, retail, residential and other commercial properties fronted onto the High Road. A former fuel station, located in the west of the site also fronted onto the High Road. N17 Studios was present to the north which consisted of offices, studios, light industrial workshops and storage space. A potential underground storage tank and electrical sub-station identified from historical maps was located within the match day car park on Paxton Road.

2.2 Ground conditions

The BGS geological map for North London indicates the sequence of strata beneath the site as being Kempton Park Gravel Formation underlain by London Clay, the Woolwich and Reading Beds and Thanet Sands. The Thanet Sands are underlain by the Upper Chalk. The southeast corner of the site is also recorded to be underlain by the Enfield Silt Formation (Brickearth) which overlies the Kempton Park Gravels. The ground conditions of the site have been well defined by various phases of intrusive investigation [1], summarised in Table 2-1 below:

Table 2-1 – Summary of ground profile

Stratum	Description	Thickness (m) ⁽¹⁾	Depth to Top (m bgl)	Level to Top (m AOD)
Made Ground	Sand and gravel with brick and cobble overlying soft brown slightly sandy gravelly clay containing brick, cobbles, ceramics, plastic, clinker, carbonaceous material, concrete, ash pockets, glass and flint.	1.2 - 3.5 (1.66)	0	11.31 - 12.83
Gravelly Clay*	Stiff reddish brown slightly sandy slightly gravelly clay. Laterally discontinuous.	0.1 - 1.6 (0.8)	1.2 - 3.5	11.5 - 9.2
Kempton Park Gravel	Dense brown sandy gravel of quartz and flint.	2.6 - 6.2 (4.05)	1.4 - 3.0	11.4 - 8.4
London Clay Formation	Stiff, very stiff grey, brownish grey and blueish grey, slightly silty/sandy slightly micaceous clay with occasional silt and sand lenses (becoming more prevalent with depth). Occasional claystone layers, rare carbonised plant remains, rare shell remains.	11.4 - 18.3 (15.6)	4.6 - 7.8	8.7 - 4.1
Lambeth Group	Very stiff (recovered as soft/very soft) fissured bluish grey mottled red and brown sandy clay becoming a gravelly sandy clay with depth. Calcareous deposits/concretions (reported as chalk and limestone) and sandstone note with depth.	5.3 - 11.45 (8.04)	16.0 - 20.9	-8.8 - 16.4

Stratum	Description	Thickness (m) ⁽¹⁾	Depth to Top (m bgl)	Level to Top (m AOD)
Thanet Sand Formation	Very dense light brown mottled grey fine to medium sand.	~15	23.55 - 27.71	-18.9 - -27.0
Upper Chalk	White Structureless Chalk	Not proven	43.0	-30.46

(1) Values presented are the range for the strata. Average BGS borehole values shown in brackets. * Possibility that gravelly layer is part of the Kempton Park Gravel, however there is also potential for this to be part of the Enfield Silt.

Perched groundwater was encountered within Made Ground however, the main groundwater body is located within the Kempton Park Gravel. Groundwater was generally resting between 1.92 and 3.66m bgl.

2.3 Conceptual site model

Potential contamination sources from former uses of the site and neighbouring area have been identified in the desk study [2] and refined by the site investigation [1]. The potential sources of contamination are tabulated below.

Table 2-2 - Potential sources of contamination

Potential Source	Location	Likely Age	Potential contaminants of concern
Made Ground (Demolition debris, historical & current industrial land uses inc. steel metal works, etc.)	On-site	~140 years	Heavy metals, other inorganic contaminants, asbestos, total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), semi-volatile and volatile organic compounds (SVOC & VOC) methane and carbon dioxide gases
Former fuel station	On-site (northwest)	~35-45 years	PAHs, MTBE, heavy metals, VOCs, SVOC, hydrocarbons (TPH, BTEX),
Potential underground storage tank	On-site	~50 years	Total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), semi-volatile and volatile organic compounds (SVOC & VOC),
Above ground storage tank (diesel)	On-site (stadium carpark)	~50 years	Total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), semi-volatile and volatile organic compounds (SVOC & VOCs).
Electrical substation	On-site (east of Paxton Road)	~35-45 years	PCBs and Mineral Oils.

A generic Quantitative Risk Assessment carried out on the basis of these data identified some potential risks that required mitigation to ensure safe redevelopment [1]. These potential risks primarily related to the presence of Made Ground, contamination of soils by the former fuel station, a potential underground storage tank (unproven at that stage) and an above ground storage tank.

2.4 Remediation objectives

The remedial objectives for the site have been defined in two categories; (i) contamination related and (ii) management/amenity related, set out below:

2.4.1 Contamination Related Objectives

1. To ensure workers engaged in the redevelopment are not exposed to concentrations of contamination in solid or gaseous/vapour phase at concentrations which could give rise to acute risks;
2. To ensure site occupiers, neighbours are not exposed to concentrations of contamination in dusts or gaseous/vapour phase at concentrations which could give rise to acute risks;
3. To ensure future site occupiers and / or visitors are not exposed to concentrations of contamination which could give rise to acute or chronic risks;
4. To ensure the quality of groundwater resources on and off site are not significantly impacted by potentially mobile inorganic or organic contaminants; and
5. To ensure that the redeveloped site cannot be determined as 'Contaminated Land'.

2.4.2 Management / Amenity Related Objectives

1. To minimise environmental impacts and ensure that 'nuisance' effects to neighbours are mitigated to acceptably low levels, and any perception of hazard (and blight) associated with the site is removed; and
2. To ensure the remedial works undertaken are cost effective.

2.5 Remediation Strategy

The remediation strategy as determined using the results of the geoenvironmental interpretative report [1] are summarised below:

Table 2-3 – Summary of remediation strategy

Receptor	Source [contaminants listed in Table 2.2]	Pathways	Mitigation Measures
Construction workers	(a) Contaminants in Made Ground	Direct contact, soil / dust ingestion	Awareness raising – remain vigilant of ground conditions at all times and report areas of potential contamination. Provision and use standard PPE. Good standard H&S and hygiene. Use of specialists for tank decommissioning and any asbestos work.
	(b) Underground storage tank		
	(c) Above ground storage tank		
	(d) Former Fuel Station		
	(e) Electrical substation		
Adjacent Site Users	(a) Contaminants in Made Ground	Dust ingestion / inhalation	Good standard of construction practices and dust management. Use of specialists when decommissioning and removing tanks and fuel station infrastructure and any asbestos work.
	(b) Underground storage tank		
	(c) Above ground storage tank		
	(d) Former Fuel Station		
	(e) Electrical substation		

Receptor	Source [contaminants listed in Table 2.2]	Pathways	Mitigation Measures
Secondary A Aquifer (Kempton Park Gravel)	(b) Potential underground storage tank	Migration of dissolved phase contamination via underlying permeable strata / piled foundations to depth.	Further investigation to determine the nature and extent of contamination and requirements for remediation. Removal of source with subsequent verification testing.
	(c) Above ground storage tank		
	(d) Former Fuel Station		
Future Site Users	(a) Contaminants in Made Ground	Direct contact, soil / dust ingestion. Inhalation (indoor / outdoor air)	Placement of hard standing between site users and in-situ soils Source removal.

3 Earthworks

3.1 Health and safety

During the earthworks a good standard of health, safety and hygiene was adopted in accordance with the site Health and Safety plan. This good practice ensured that the potential risks to construction workers and occupiers of neighbouring buildings, associated with contact and ingestion of Made Ground released into air as dust was appropriately mitigated i.e. dust control measures such as wetting down haulage routes and washing down of vehicles were adopted.

3-1 – Wetting down of haulage routes shown during Enabling Works excavation of the basement



During the periodic site inspections carried out by BuroHappold Engineering during the Enabling Works and main works (as well as by other staff on the project team) there was no evidence of environmental nuisance (or hazard) associated with dust generation from excavation activities or other works.

3.2 Controlled waters

During excavation of the basement car park in 2013 and up until complete closure of the basement in early 2018 shallow groundwater within the Kempton Park Gravel required pumping to lower the groundwater table to prevent inundation of the basement occurring. Control of the groundwater required pumping and disposal of water to sewer and WJ Groundwater designed the de-watering system to achieve this. The disposal was carried out with the agreement of and licensed by Thames Water with water being discharged to a receiving manhole on the site perimeter. The groundwater encountered exhibited no evidence (visual or olfactory) of any contamination and periodic testing undertaken by WJ Groundwater from the outfall points confirmed the discharged water met the Thames Water discharge consent conditions. A copy of the discharge licence and available testing data undertaken by WJ Groundwater is included in Appendix A.

3.3 Excavation and disposal of soils

Significant quantities of Made Ground, Gravelly Clay and Kempton Park Gravel have been excavated to form the stadium and hotel basements to reduce the site level to formation level. Plate 2 shows the extent of basements. The stadium basement was excavated in two phases, to 10.5mAOD, sheet pile walls were then installed and excavation to formation level as detailed below was undertaken. Basements were excavated to between 7.01mAOD on the west and 6.773mAOD on the east of the site with formation level excavations (in the area of the new pitch and surrounding surfacing areas) extending up to 10.5mAOD, Pre construction site levels being between 11.3mAOD and 12.5mAOD.

The following material types were excavated and their use or disposal route is set out in Table 3-1 below.

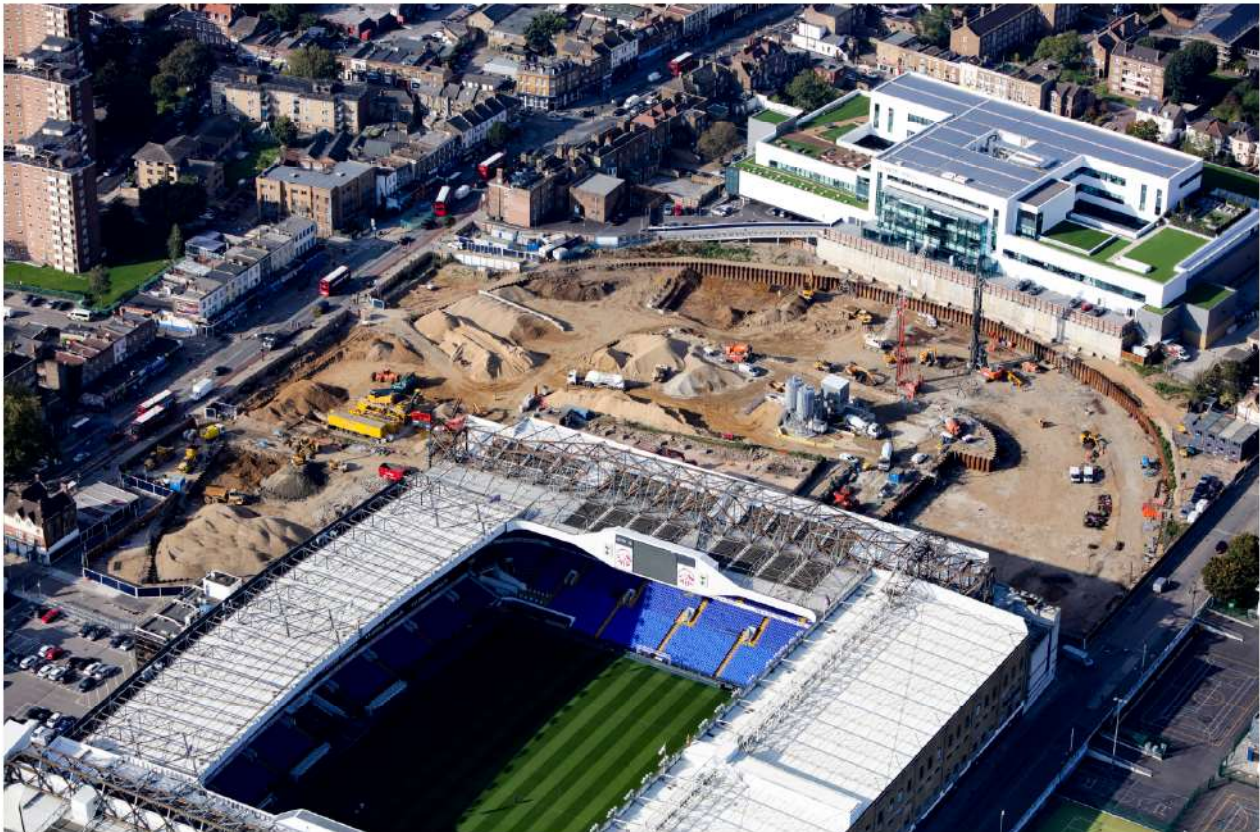
Table 3-1 – Excavated materials table

Material	Fate of material
Hard standing	Concrete hard standing was crushed on site and re-used as part of the piling mat. Asphalt was removed from site and taken to a specialist facility (Marlow House) for recycling.
On site stockpiles	On receiving the site prior to Enabling Works some stockpiled material was present on site (related to previous off site works constructing Lilly White House). One of these stockpiles contained Japanese Knotweed following chemical treatment.
Made Ground	Initial northern enabling works dig Made Ground was sent to Guy Lodge Farm under a CL:AIRE Materials Management Plan. Later Made Ground excavations were disposed of to suitably licenced landfill. No excavated Made Ground retained on site. Hydrocarbon impacted Made Ground disposed of to landfill.
Gravelly Clay	Clay content too high for gravel washing. This material went to suitably licenced landfill where hydrocarbons were present or Guy Lodge Farm when no hydrocarbons were present.
Kempton Park Gravel	This material was gravel washed. Gravel was separated for use in concrete to construct the stadium as was sand. CL:AIRE code of practice used. Small quantities of clay separated and disposed off site to suitably licenced landfill.
London Clay	Mostly encountered in pile arisings. Disposed offsite to suitably licenced landfill.

Figure 3-2 - Gravel washing plant and polished gravel slab using recovered excavated gravel from site at level one of the stadium west stand



Figure 3-3 - Basement excavations October 2015, gravel stockpiles from gravel washing present in the west of the site



3.3.1 Material Management Plans

Two separate material management plans were required under the CL:AIRE Waste Code of Practice scheme to facilitate the material movements described in Table 3-1. The first provided in Appendix B is to allow the movement of Made Ground from site to form a noise bund at Guy Lodge Farm. The second provided in Appendix C is to allow the re-use of the site won gravel and sand in concrete for constructing the stadium. Concrete created using site won gravel and sand was mainly used to form the basement slabs but some was also used on the upper levels and made a feature of by polishing the concrete as illustrated in Figure 3-2.

3.3.2 Excavated soil volumes

Volumes provided are in m³ but no bulking factors have been applied.

The total excavated volume was 86,500m³. Of which 20,500m³ went to Guy Lodge Farm, 22,300m³ was recovered washed gravel and sand, 5,800m³ was concrete hard standing which was crushed and used as a pile mat for construction with the remaining 37,900m³ going to landfill.

In addition 15,700m³ of pile arisings i.e. not included in the excavated volume total above were disposed off-site to landfill.

3.3.3 Material to landfill

The majority of material that went to landfill was classified as Non Hazardous waste. Waste transfer notes for the transfer of material to landfill are saved electronically by BuroHappold and access can be arranged on request (file size too large for inclusion with this report). Small amounts of soil impacted by hydrocarbons in the area of BH09-12 and immediately surrounding the discovered underground tank within the basement dig area was removed to landfill as Hazardous Waste.

4 Remedial Works

No unexpected contamination was encountered during excavation works. The below sections outline specific issues and items that were encountered and the works undertaken to deal with them. Figure 4-6 illustrates their locations. It should be noted that on removal of the electrical substation concrete slab there was no evidence of contamination impact in the underlying ground which was subsequently excavated to form the western part of the stadium basement. Hydrocarbon contamination of site materials noted in Sections 4.2 and 4.3 below were present between 3-4m above the basement formation level and it was very clear through visual and olfactory means that hydrocarbon impact extended no further than 1.0m below the source areas. The basement formation level was therefore well below the area of hydrocarbon impacted materials in the three locations identified (by at least 2m). No visual or olfactory evidence of contamination remained at basement formation level.

4.1 Petrol Station

Five underground tanks were present within an area associated with the former petrol station which formed part of the redevelopment area. Prior to commencement of the enabling works, the tanks had been backfilled with foam by previous owners but were still present within the ground.

The petrol station works comprised the following which were undertaken by Downwell Demolition:

- Decommissioning of infrastructure;
 - Excavation and removal of five underground tanks;
 - Excavation and removal of all associated pipework (e.g. from tanks to fuel pumps and to vent stack);
 - Flushing of site drainage and removal of silt / sediment and water from interceptor;
 - Excavation and removal of interceptor.
- Validation testing of soils at each location following removal of tanks and interceptor (3 per tank / interceptor), including analysis for TPH CWG, BTEX and PAHs;
- Demolition of on-site buildings;
- Removal of obstructions within the top 2m; and
- Backfilling of all excavations with suitable, 'clean' site won material (e.g. brick fill from site demolition); and

Validation testing was undertaken by Southern Testing on 28th August 2014 on behalf of Downwell Demolition (full report provided in Appendix D), which included obtaining samples of residual soils following the removal of the underground fuel tanks. During the validation visit, four trial pits were excavated through the backfilled tank excavation to depth of between 2.8-3.3m below existing ground level.

No visual or olfactory evidence of any hydrocarbon contamination was noted in the trial holes. Head space testing using a Photo-Ionization Detection (PID) was also carried out on selected samples – this did not show any readings above 0.0 ppm. A sample of the residual holes from each of the trial holes was taken and submitted for laboratory analysis for TPH. All of the results were below the laboratory limits of detection (<10 mg/kg); therefore, the residual soils within the backfilled tank excavation would be considered uncontaminated as regards fuel hydrocarbons.

The Southern Testing report demonstrates that the petrol station was appropriately decommissioned and that no significant contamination was present. The areas was subsequently excavated (apart from the area immediately adjacent to the High Road) to form the eastern part of the stadium basement.

4.2 Underground storage tank

As part of the original ground investigation shallow hydrocarbon contamination was recorded in the location of BH09-12 and WS22 on the eastern side of the site and historic information suggested that an underground storage tank may be present in that area. A localised area of hydrocarbon impacted soil was identified during the basement excavation and was removed from site as part of the basement dig but no underground storage tank was found to be present in the area of BH09-12 or WS22.

An underground fuel tank was discovered in the west of the site as shown in Figure 4-6 on the 4/3/15. This tank contained liquid which appeared to be a hydrocarbon. The tank was pumped out by tanker and the liquid appropriately disposed of. Some slightly hydrocarbon impacted soil was present around the tank this was excavated and segregated for offsite disposal. The tank was then removed from site and the whole area was later excavated as part of the western basement car park excavation.

Figure 4.1 - UST containing liquid discovered during basement excavations on the 4/3/15



Figure 4.2 – Emptying of the UST on the 11/3/15 to tanker for disposal



4.3 Above ground storage tank

An above ground fuel storage tank was located within the former White Hart Lane Stadium car park. The tank was used for storing hydrocarbons but was empty when removed in early 2017. Some residual staining was present beneath the tank. The whole area was excavated as part of the hotel basement excavation and the impacted soil removed to landfill.

4.4 Landscape areas and external finishes

The scheme does not include any landscaped areas which are directly in contact with in-situ soils. Self-contained planters containing imported topsoil are located above concrete slabs in locations shown in Plate 1. All other external areas are surfaced with various block paving often underlain by concrete as shown in Figure 4-3 and detailed in Plate 1. There is therefore no viable pathway between site users and underlying soils in the landscape areas or other external areas.

Figure 4-3 External hardstanding finishes being completed, block paving yet to be installed when this image was taken



4.5 Former water well

A water well of approximately 5.5m depth was encountered in the southwest part of the site (NGR TQ 33946 91097) during demolition works. This was considered to be a potential pathway for migration of contamination, and as such was decommissioned by means of backfilling with gravel and sealing using a concrete cap.

Figure 4-4 – Former water well encountered during excavations



4.6 Broken asbestos sheeting

A small area of broken asbestos sheeting was discovered in the south of the former White Hart Lane Stadium car park on the 4/7/17 as the area was being reduced to formation. The area was cordoned off and a specialist asbestos removal company engaged. They removed the bulk asbestos cement sheets and picked the asbestos sheet fragments from the soil and paced in bags for disposal. The soil in the area was then excavated down to formation levels and disposed offsite.

Figure 4-5 – Broken asbestos sheeting



Figure 4-6 - Plan showing remedial works items locations



5 Ground Gas Regime

5.1 General

Ground gas monitoring was undertaken at 21 locations across the site on between six and seven separate occasions at weekly intervals between 20th May and 4th August 2010. Visits were undertaken during both rising, falling and steady atmospheric pressure episodes. Slightly elevated concentrations of carbon dioxide were recorded (up to 7.7% v/v) and low methane concentrations (up to 0.3% v/v) were recorded over the monitoring period. Elevated concentrations of carbon monoxide were also recorded (up to 59 ppm), however these elevated concentrations were not consistent over the entire monitoring period. Consistently low flow rates were observed, up to 0.5 l/hr. The geoenvironmental interpretative report [1] stated the following: *the highest concentration of carbon dioxide and the highest flow rate recorded on site produce a GSV of 0.04 indicating that the ground gas regime beneath the site falls within Characteristic Situation 1, Very Low Risk. However, the guidance also states that if carbon dioxide concentrations are greater than 5% v/v consideration should be given to increasing the Characteristic Situation to CS2.*

5.2 Further consideration of data

The ground gas data has been further considered to take into account details of the development that were not known at the time of writing of the interpretative report [1]. From the data concentrations of carbon dioxide in excess of 5% v/v were only recorded at two locations:

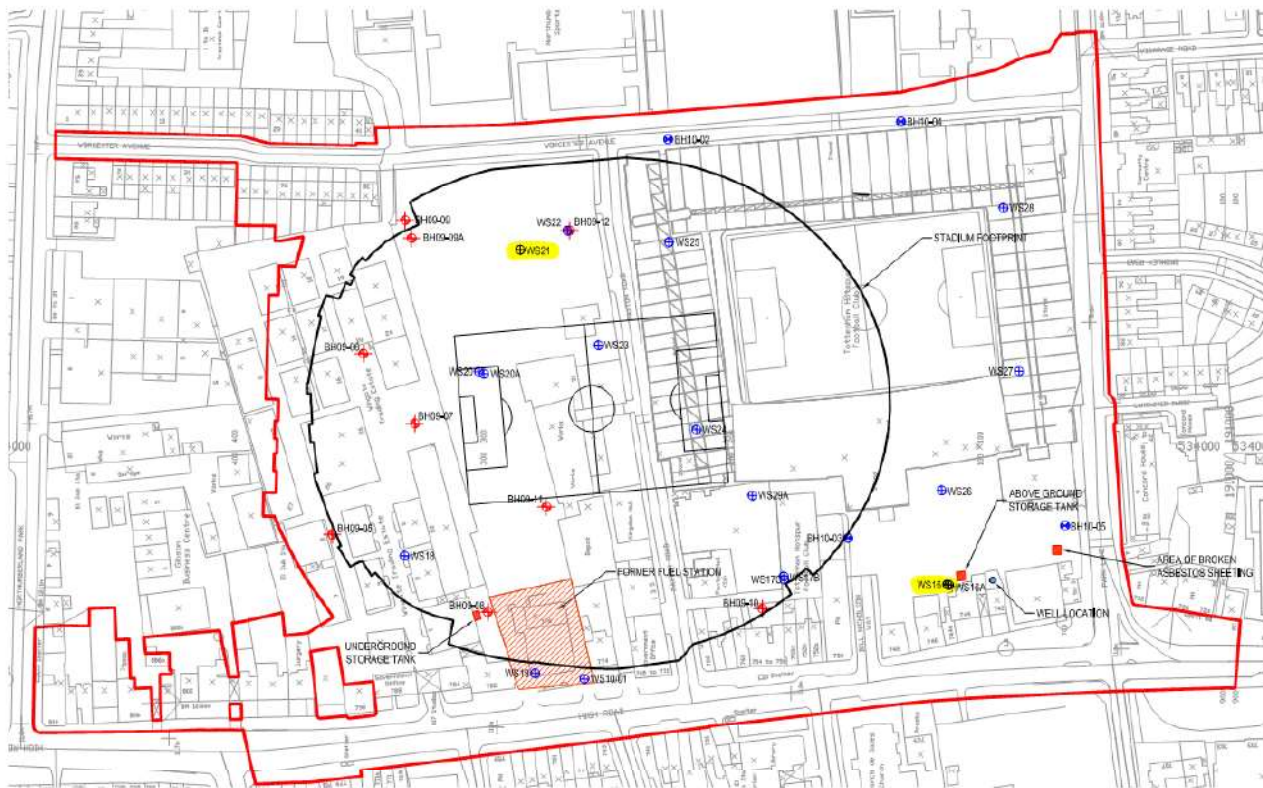
- WS16: concentration of CO₂ above 5% v/v recorded on one out of seven monitoring rounds (5.4% v/v). Concentrations of 0.5%, 1.1%, 0.6%, 0.7%, 3.1% and 0.0% v/v recorded on other occasions. Response zone from 1m bgl to 5m bgl within 0.8m Gravelly Clay and 4.2m Kempton Park Gravels. A dark grey oily residue with a moderate hydrocarbon odour was noted on the ground investigation logs between 2.08 and 2.40m bgl, and a moderate hydrocarbon odour below 2.50m bgl.
- WS21: concentration of CO₂ above 5% v/v recorded on three out of six monitoring rounds (6.5%, 6.5% and 7.7% v/v). Response zone from 1m bgl to 6m bgl within 0.2m Made Ground, 1.4m Gravelly Clay and 4.4m Kempton Park Gravels. A slight hydrocarbon odour was noted on ground investigation logs at 3.50m bgl.

As such the source of the slightly elevated carbon dioxide concentrations may be Made Ground and / or the hydrocarbon impacts recorded at each location. Figure 5-1 highlights the location of WS16 and WS21. Given that all other locations recorded CO₂ below 5% and also did not record hydrocarbon odour it seems likely the slightly elevated CO₂ recorded a result of local hydrocarbon degradation processes.

5.3 Removal of source

As part of design development for the project it was decided that an extensive basement beneath much of the stadium and a further basement for the future hotel which extends south on the west side of the site. The extent of these basements is shown in Plate 2. The excavation of the basement has resulted in the material monitored at both locations being fully removed with natural material impacted by hydrocarbons also removed (no visual or olfactory evidence of contamination extending below basement formation levels). This source removal is likely to have removed the source of the recorded elevated carbon dioxide and therefore it is considered that the stadium and hotel development fall into Characteristic Situation 1 and therefore no gas protection measures are required.

Figure 5-1 – Location of wells that recorded slightly elevated concentrations of carbon dioxide.



6 Conclusions

6.1 Achievement of remedial objectives

The Remediation Strategy (summarised here in Section 2) has been successfully delivered by the works with the contamination related objectives achieved as follows;

1. An appropriate good standard of health safety and hygiene was adopted in line with the Health & Safety Plan which mitigated the potential risks to construction workers.
2. That same good standard of construction practice mitigated the potential risks to site neighbours during construction.
3. There was no adverse impact on groundwater quality during the work with groundwater being lowered during the majority of the construction period and discharge to sewer, the quality of this discharge was monitored. No significant hotspots of contamination were encountered and those that were encountered were excavated and removed during earthworks so removing the potential source of groundwater contamination.
4. The satisfactory implementation of the Remediation Strategy has mitigated the potential risks to people and the environment such that there is no significant possibility of significant harm during the future occupation of the stadium or hotel.

6.2 Compliance with Remediation Strategy

6.2.1 Earthworks and contamination

The identified areas of concern were investigated and have been mitigated through excavation and removal of impacted materials. Future site users can not be in direct contact with site soils due to the surface finishes adopted and it has been demonstrated that the site buildings do not require soil gas protection measures.

No unforeseen contamination was encountered within the soils or groundwater on-site during the earthworks. Excavated soils were either disposed of off-site to appropriately licensed facilities, reused on site (natural gravel and sand following processing) or taken to Guy Lodge Farm to form a noise bund under the CL:AIRE code of practice.

6.3 Long term management and maintenance

No long term management or maintenance measures beyond maintaining hard standing in external areas is required.

6.4 Status of site at completion of earthworks

On the basis of the above, it is concluded that the provisions of Condition 59 (concerned with unforeseen contamination), have been met (reflecting the absence of any such unforeseen contamination).

This report also presents the evidence demonstrating the effective implementation of the agreed remedial measures in accordance with Condition 58(4) of the planning permission. Accordingly, this report should be formally submitted to the Local Authority for their consideration with respect to the discharge of Conditions 58 and 59 in respect to the development.

References

- Ref. 1 BuroHappold. Northumberland Development Project, Stadium. Geoenvironmental Interpretive Report. Rev 00, October 2010.
- Ref. 2 BuroHappold, Northumberland Development Project, Geotechnical Desk Study and Preliminary Geoenvironmental Risk Assessment. THFC-BHE-ZZ-LXX-RP-CG-0001. November 2008.

Plate 1 - Landscape General Arrangement

Plate 2 – Basement areas plan

Appendix A Discharge licence and available testing data



THAMES WATER UTILITIES LTD.
Water Industry Act 1991

PERMIT TO DISCHARGE GROUNDWATER

WHEREAS

1. Mace Limited
155 Moorgate
City of London
London
EC2M 6XB

is/are Permitted to make a Groundwater discharge at the site known as
New Stadium Development Northumberland Park and situate at
Meldene Limited
Lilywhite House
780 High Road
Haringey
London
N17 0BX

(hereinafter called THE SITE) and by application dated First day of April, Two Thousand and Sixteen has applied to Thames Water Utilities Ltd. Registered in England & Wales under Company number 2366661, whose registered office is at Clearwater Court, Vastern Road, Reading, Berks. RG1 8DB. (hereinafter called "THE COMPANY") to Permit to the discharge of Groundwater by him/her/them from THE SITE into the Company's sewerage network.

Commencement of
discharge.

1. THE COMPANY HEREBY PERMITS to the discharge of Groundwater from the Site into the Company's sewerage network subject to the following conditions:
The commencement date of this Permit will be the date on which the Permit is signed by the Company's Senior Consultant for Wastewater Quality (or any other officer or employee duly authorised by the Company for these purposes).
The Applicant must not discharge the Groundwater before the commencement date.
This Permit will be valid until Sixteenth day of March, Two Thousand and Seventeen whereby the discharge must then cease .
An application to extend the Permit must be put in writing to the Company no later than 21 days before the above expiry date. The Company does not guarantee that an extension will be granted and the discharge must cease on the last day of validity.

Nature and composition Sewer(s) affected	2. The nature and composition of the discharge under this Permit is hereby restricted to Groundwater only. 3. The sewer(s) into which the Groundwater may be discharged is/are the sewer(s) detailed below: 675mm Foul Sewer High Road And more particularly shown in line(s) on the annexed plan and thereon coloured red. The point(s) at or through which the Groundwater is to be discharged is/are shown on the said Plan and thereon marked blue. No change shall be made in such point(s) of discharge without prior Permit in writing of the Company.
Total volume Permitted	4. 283824.000m ³ .
Maximum quantity to be discharged	5. The maximum quantity of the Groundwater which may be discharged on any one day of twenty-four hours determined from midnight to midnight shall not exceed 777.600m ³ .
Maximum rate of discharge	6. a) The maximum rate at which the Groundwater may be discharged shall not exceed 32.400m³ per hour. b) The maximum rate at which the Groundwater may be discharged shall not exceed 9.000 litres per second.
Matter to be eliminated prior to discharge to the sewer(s)	7. (a) There shall be eliminated from the Groundwater before it is discharged into the sewer(s) any matter, which, either alone or in combination with any matter with which it is likely to come into contact while passing through any sewers, would injure or obstruct any such sewers or cause injury to and/or damage to the health of any person lawfully present in such sewers, pumping stations or sewage treatment works or would make specially difficult or expensive the treatment or disposal of their contents and in particular but without prejudice to the generality of the foregoing words the following matters:- (i) Petroleum spirit (ii) Calcium carbide (iii) Thiourea and thiourea derivatives (iv) Non biodegradable detergents (b) The Groundwater shall not contain substances listed in Schedule 1 of the Trade Effluent (Prescribed Processes and Substances) Regulations 1989, as amended, at a concentration greater than background concentration as defined in such regulations. (c) The Groundwater shall not contain any of the substances listed in APPENDIX 1 at a concentration expressed in milligrams per litre greater than that stated. SEE APPENDIX 1
Acidity or alkalinity	8. No Groundwater shall be discharged the pH value of which is less than 6.0 or greater than 11.0.

- | | |
|--|---|
| Changes in occupier or process | 9. The Permit Holder(s) shall forthwith give to the Company notice in writing of any changes or proposed changes in the company name, address, occupier, contractor or of any other circumstances which may alter the nature and composition or the volume of the Groundwater. Failure to do so will result in the termination of the Permit. |
| Payment | <p>10. The Applicant of the Premises shall pay to the Company for the Groundwater discharged into the sewer</p> <p>(a) A sum calculated in accordance with the provisions contained in the Company's Charges Scheme together with</p> <p>(b) The amount of any additional expenses which the Company may from time to time incur with respect to the monitoring, analysis, reception, treatment and disposal of the Ground Water.</p> |
| Entry and samples | 11. The Permit Holder(s) shall allow duly authorised representatives of the Company to inspect, examine and test at all reasonable times any works and apparatus installed in connection with the Groundwater discharge and to take samples of the Groundwater, to demonstrate compliance with the terms of this Permit. The Permit Holder(s) shall also allow duly authorised representatives of the Company to supervise and or inspect the disposal of the Groundwater and be liable for any associated costs. |
| Inspection | <p>12. (a) An inspection chamber or manhole shall be provided and maintained by the Permit Holder(s) in a suitable position defined in connection with each pipe through which the Groundwater being discharged and such inspection chamber or manhole shall be so constructed and maintained by the Permit Holder(s) as to enable duly authorised representatives of the Company to take samples at any time of the Groundwater passing into the Company's sewerage network.</p> <p>(b) It is the Permit Holder(s) responsibility to provide evidence on demand of suitable alternative disposal method(s), should the discharge be deemed by the Company at any time as unsuitable for discharge to the Company's sewerage network.</p> |
| Measurement and determination of discharge | <p>13. (a) A notch gauge and continuous recorder or some other apparatus suitable and adequate for measuring and automatically recording the volume, nature, composition and rate of discharge of the Groundwater being discharged into the Company's sewerage network shall, if required by the Company be provided and maintained by the Permit Holder(s) at their cost and to the satisfaction of the Company in connection with every pipe through which the Groundwater is being discharged.</p> <p>(b) Calibration of discharge meters shall be on installation and no less that once per annum thereafter.</p> <p>(c) It is a requirement of this permit that if a Groundwater meter(s) is/are installed it/they will be calibrated at least annually or more frequently if specified by the Company and certificated by a suitably qualified person and/or company approved by the Company.</p> |

Records

14. (a) Records in such a form as the Company may require shall be kept of the volume, rate of discharge, nature and composition of the Groundwater discharged into the Company's sewerage network and shall be available at all reasonable times for inspection by duly authorised representatives of the Company and copies of such records shall be sent to the Company on demand.
- (b) The Permit Holder(s) will ensure that the volume of the discharge is metered or otherwise measured and that the records of the volumes and all calibration certificates will be made available to the Company within 48 hours of being requested.
- (c) By failing to comply with this request, the Permit Holder(s) agree to pay the Company on demand, a Company assessed bill or account based on the highest volumetric data declared on the application.
- (d) The foregoing provisions of this condition shall be of no effect so long as there is available to the satisfaction of the Company some other method approved by the Company of sampling the Groundwater or of determining, measuring and recording the volume and rate of discharge and the composition of the Groundwater discharged.

Indemnities and Insurance

15. It is the Permit Holder's responsibility to:
 - (a) Indemnify the Company against all claims for damage to property or injury to / death of persons arising from the discharge of Groundwater.
 - (b) To have Public Liability insurance in an amount of not less than £1 million for any one occurrence or series of occurrences which may give rise to a claim or claims for damage to property or injury to / death of persons, arising from the discharge.
 - (c) That if requested, produce within 48 hours satisfactory evidence that such insurance is in force.

Health and Safety

16. The Permit Holder will inform the Company of any special Health and Safety requirements that need to be observed by Company representatives visiting the site and provide additional supervision if required.

Vacation of Site

17. It is the Permit Holder's responsibility to notify the Company in writing at least 21 days in advance of the following events:
 - (a) Vacation of the Site by the Permit Holder(s) for any reason, whether permanent or temporary;
 - (b) Change of ownership or occupation of the Site;
 - (c) The Permit Holders entry into liquidation whether voluntarily or compulsorily or bankruptcy, if an individual;
 - (d) The presentation of a petition for the appointment of an administrator or a receiver or manager in respect of the Permit Holders undertakings;
 - (e) Cessation of discharge of Groundwater from the Site. In this instance it is also the Permit Holders responsibility to supply to the Company all relevant volumetric discharge data.



Reservation of Rights 18. The Company reserves the following rights:

- (a) To require the discharge to be discontinued immediately should the discharge in the Company's opinion, cause, or risk causing, any health and safety, public health, operational, or environmental breaches or issues.
- (b) To terminate this Permit at any time should the Permit Holder be in breach of any terms and conditions.
- (c) To refuse future applications should the Permit Holder be in breach of any terms and conditions.
- (d) To instigate prosecution proceedings in respect of
 - (i) Disposals of Groundwater in contravention of these terms and conditions;
 - (ii) Any contravention of the Company's byelaws, regulations or other statutory provisions made for preventing waste, pollution, misuse or contamination of water;
 - (iii) Any contravention of any Permit conditions imposed.

Additional Clauses 19. Any additional clauses pertaining to this Permit will be shown in Appendix 4 where applicable.

Signed:

T. McHattie

Tony McHattie
Trade Effluent Manager

Duly authorised to sign on behalf of the Company

Dated *fourth* day of *April, Two Thousand and Sixteen*

NOTES:

- a) Pursuant to S.111 of the Water Industry Act 1991 it is an offence to throw, empty or turn or suffer or permit to be thrown or emptied or to pass in to any public sewer or into any drain or sewer communicating with a public sewer any matter likely to injure the sewer or drain, to interfere with the free flow of its contents or to affect prejudicially the treatment and disposal of its contents, or to cause a nuisance or injurious, or likely to cause injury to health.
- b) All communications should be sent to the following address

Risk Management Team
Thames Water Utilities Ltd
Crossness Sewage Treatment Works
Belvedere Road
Abbey Wood
London
SE2 9AQ

APPENDIX 1 - SUBSTANCES

The Ground water shall not contain any of the substances listed below at a concentration expressed in milligrams per litre greater than that stated:

Determinand Name	Permitted Limit
Suspended Solids	2000.0
Sulphate	1800.0
Chloride	1500.0
Settleable Solids	500.0
Chemical Oxygen Demand	100.0
Rapidly Settleable Solids	100.0
Unsaponifiable Material	50.0
Ammoniacal Nitrogen	35.0

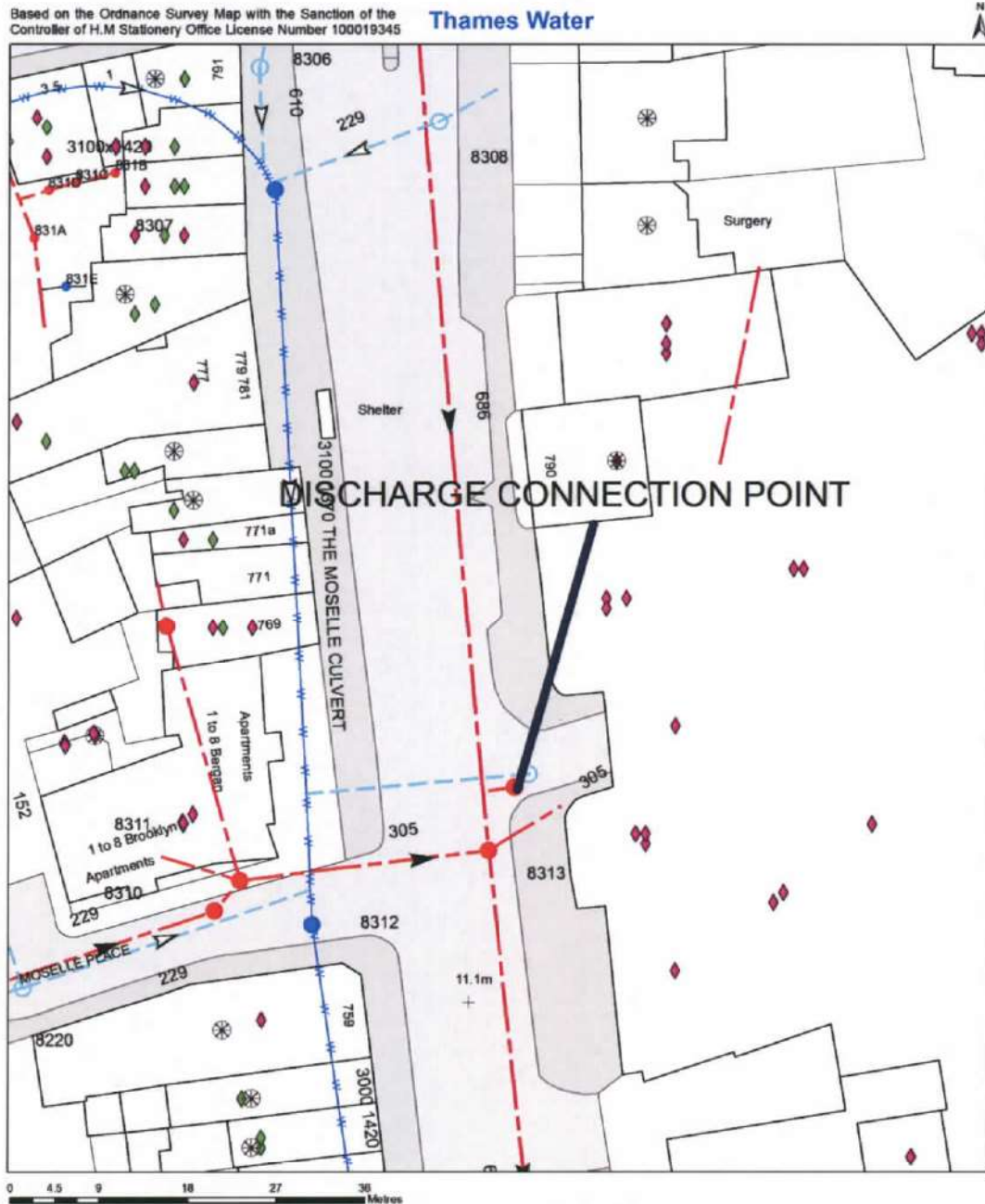
THERE ARE NO FURTHER LIMITS IN THIS APPENDIX

APPENDIX 2 - DISCHARGE POINTS

THERE ARE NO MORE DISCHARGE POINTS

APPENDIX 3 - SEWER PLAN

dsp



The position of any boundary or apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. No liability of any kind whatsoever is accepted by Thames Water for any error or omission.

Printed At (A4) : 1:500
 Printed By : NGORHAM
 Print Date : 21/03/2016
 Map Centered On : 533890,191335
 Grid Reference : TQ3391





APPENDIX 4 - ADDITIONAL CLAUSES

NO ADDITIONAL CLAUSES AVAILABLE

Report Number: 616437-1

Date of Report: 02-Dec-2016

Customer: WJ Groundwater
Unit 5 Abbotts Business Park
Primrose Hill
Kings Langley
Hertfordshire
WD4 8FR

Customer Contact: Mr Tom Stockman

Customer Job Reference:

Customer Purchase Order: PO29529

Customer Site Reference: THFC

Date Job Received at SAL: 23-Nov-2016

Date Analysis Started: 24-Nov-2016

Date Analysis Completed: 02-Dec-2016

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with SAL SOPs

All results have been reviewed in accordance with Section 25 of the SAL Quality Manual



1549

Report checked
and authorised by :
Aislinn Arthey
Trainee Project Manager

Issued by :
Aislinn Arthey
Trainee Project Manager



SAL Reference: 616437 Project Site: THFC Customer Reference: Water Analysed as Water Suite A						
SAL Reference				616437 001	616437 002	
Customer Sample Reference				THFC WEST	THFC EAST	
Date Sampled				18-NOV-2016	18-NOV-2016	
Determinand	Method	Test Sample	LOD	Units		
As (Dissolved)	T281	F	0.0002	mg/l	0.0020	0.0015
Fe (Dissolved)	T281	F	0.005	mg/l	<0.005	<0.005
Fe (Total)	T301	AR	0.005	mg/l	18	3.8
Mn (Dissolved)	T281	F	0.010	mg/l	0.076	0.040
pH	T7	F			8.0	8.0
Electrical Conductivity	T7	F	1	µS/cm	1100	980
Alkalinity expressed as CaCO ₃	T22	F	20	mg/l	160	170
Total Hardness expressed as CaCO ₃	T649	F	10	mg/l	400	410
Biochemical Oxygen Demand (Allyl Thiourea)	T264	F	1	mg/l	4	3
Chemical Oxygen Demand	T221	F	20	mg/l	44	<20
Total Dissolved Solids	T808	F	1	mg/l	720	660
Suspended Solids (Total)	T2	AR	10	mg/l	360	120
Diss Oxygen	T7	AR	1.0	mg/l	4.8	7.9
Sulphate	T686	F	0.5	mg/l	230	170
Chloride	T686	F	1	mg/l	85	75
Nitrate	T686	F	0.5	mg/l	22	33
Nitrite	T686	F	0.1	mg/l	0.7	0.6
Phosphate	T686	F	0.5	mg/l	0.8	<0.5
Ammonia expressed as NH ₄	T686	F	0.05	mg/l	0.07	<0.05
Cyanide(Total)	T546	F	0.01	mg/l	<0.01	<0.01
Phenols(Mono)	T546	F	0.02	mg/l	<0.02	<0.02
Sodium	T6	F	0.05	mg/l	69	64
Magnesium	T6	F	0.1	mg/l	10	13
Potassium	T6	F	0.05	mg/l	28	23
TPH (C10-C40)	T219	AR	20	µg/l	60	60

Index to symbols used in 616437-1

Value	Description
F	Filtered
AR	As Received
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Phenols: Due to machine breakdown these samples have been analysed exceeding recommended holding times. It is possible therefore that the results provided may be compromised.

TPH: These samples have been analysed exceeding recommended holding times. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T7	Probe
T22	Titration
T221	Colorimetry (CE)
T281	ICP/MS (Filtered)
T301	ICP/MS (Total)
T546	Colorimetry (CF)
T808	Calc (by EC)
T2	Grav
T219	GC/FID (SE)
T6	ICP/OES
T264	Probe (Incubation Carbonaceous) (5 Days)
T649	ICP/OES (Calc)
T686	Discrete Analyser

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
As (Dissolved)	T281	F	0.0002	mg/l	U	001-002
Fe (Dissolved)	T281	F	0.005	mg/l	U	001-002
Fe (Total)	T301	AR	0.005	mg/l	U	001-002
Mn (Dissolved)	T281	F	0.010	mg/l	U	001-002
pH	T7	F			U	001-002
Electrical Conductivity	T7	F	1	µS/cm	U	001-002
Alkalinity expressed as CaCO ₃	T22	F	20	mg/l	U	001-002
Total Hardness expressed as CaCO ₃	T649	F	10	mg/l	U	001-002
Biochemical Oxygen Demand (Allyl Thiourea)	T264	F	1	mg/l	N	001-002
Chemical Oxygen Demand	T221	F	20	mg/l	N	001-002
Total Dissolved Solids	T808	F	1	mg/l	N	001-002
Suspended Solids (Total)	T2	AR	10	mg/l	N	001-002
Diss Oxygen	T7	AR	1.0	mg/l	N	001-002
Sulphate	T686	F	0.5	mg/l	U	001-002
Chloride	T686	F	1	mg/l	U	001-002
Nitrate	T686	F	0.5	mg/l	U	001-002
Nitrite	T686	F	0.1	mg/l	U	001-002
Phosphate	T686	F	0.5	mg/l	U	001-002
Ammonia expressed as NH ₄	T686	F	0.05	mg/l	U	001-002
Cyanide(Total)	T546	F	0.01	mg/l	U	001-002
Phenols(Mono)	T546	F	0.02	mg/l	U	001-002
Sodium	T6	F	0.05	mg/l	U	001-002
Magnesium	T6	F	0.1	mg/l	U	001-002
Potassium	T6	F	0.05	mg/l	U	001-002
TPH (C10-C40)	T219	AR	20	µg/l	U	001-002

SCIENTIFIC ANALYSIS
LABORATORIES

Report Number: 622668-1

Date of Report: 05-Jan-2017

Customer: WJ Groundwater
Unit 5 Abbots Business Park
Primrose Hill
Kings Langley
Hertfordshire
WD4 8FR

Customer Contact: Mr Tom Stockman

Customer Job Reference:

Customer Site Reference: THFC

Date Job Received at SAL: 20-Dec-2016

Date Analysis Started: 21-Dec-2016

Date Analysis Completed: 04-Jan-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with SAL SOPs

All results have been reviewed in accordance with Section 25 of the SAL Quality Manual



1549

Report checked
and authorised by :
Aislinn Arthey
Trainee Project Manager

Issued by :
Aislinn Arthey
Trainee Project Manager



SAL Reference: 622668 Project Site: THFC Customer Reference: Water Analysed as Water Suite A						
SAL Reference				622668 001	622668 002	
Customer Sample Reference				East Discharge	West Discharge	
Date Sampled				19-DEC-2016	19-DEC-2016	
Determinand	Method	Test Sample	LOD	Units		
As (Dissolved)	T281	F	0.0002	mg/l	0.0017	0.0009
Fe (Dissolved)	T281	F	0.005	mg/l	<0.005	<0.005
Fe (Total)	T301	AR	0.005	mg/l	1.4	0.016
Mn (Dissolved)	T281	F	0.010	mg/l	0.078	0.056
pH	T7	F			8.2	8.0
Electrical Conductivity	T7	F	1	µS/cm	950	880
Alkalinity expressed as CaCO ₃	T22	F	20	mg/l	180	210
Total Hardness expressed as CaCO ₃	T649	F	10	mg/l	370	340
Biochemical Oxygen Demand (Allyl Thiourea)	T264	F	1	mg/l	<1	3
Chemical Oxygen Demand	T221	F	20	mg/l	<20	<20
Total Dissolved Solids	T808	F	1	mg/l	640	590
Suspended Solids (Total)	T2	AR	10	mg/l	74	<10
Diss Oxygen	T7	AR	1.0	mg/l	10	6.3
Sulphate	T686	F	0.5	mg/l	170	93
Chloride	T686	F	1	mg/l	72	74
Nitrate	T686	F	0.5	mg/l	31	19
Nitrite	T686	F	0.1	mg/l	1.4	<0.1
Phosphate	T686	F	0.5	mg/l	<0.5	1.0
Ammonia expressed as NH ₄	T686	F	0.05	mg/l	0.05	<0.05
Cyanide(Total)	T546	F	0.01	mg/l	<0.01	<0.01
Phenols(Mono)	T546	F	0.02	mg/l	<0.02	<0.02
Sodium	T6	F	0.05	mg/l	53	49
Magnesium	T6	F	0.1	mg/l	9.4	8.9
Potassium	T6	F	0.05	mg/l	20	17
TPH (C10-C40)	T219	AR	20	µg/l	90	40

Index to symbols used in 622668-1

Value	Description
AR	As Received
F	Filtered
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

TPH: Due to laboratory error these samples have been analysed exceeding recommended holding times. It is possible therefore that the results provided may be compromised.

Method Index

Value	Description
T281	ICP/MS (Filtered)
T649	ICP/OES (Calc)
T2	Grav
T221	Colorimetry (CE)
T7	Probe
T546	Colorimetry (CF)
T686	Discrete Analyser
T808	Calc (by EC)
T6	ICP/OES
T22	Titration
T301	ICP/MS (Total)
T264	Probe (Incubation Carbonaceous) (5 Days)
T219	GC/FID (SE)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
As (Dissolved)	T281	F	0.0002	mg/l	U	001-002
Fe (Dissolved)	T281	F	0.005	mg/l	U	001-002
Fe (Total)	T301	AR	0.005	mg/l	U	001-002
Mn (Dissolved)	T281	F	0.010	mg/l	U	001-002
pH	T7	F			U	001-002
Electrical Conductivity	T7	F	1	µS/cm	U	001-002
Alkalinity expressed as CaCO ₃	T22	F	20	mg/l	U	001-002
Total Hardness expressed as CaCO ₃	T649	F	10	mg/l	U	001-002
Biochemical Oxygen Demand (Allyl Thiourea)	T264	F	1	mg/l	N	001-002
Chemical Oxygen Demand	T221	F	20	mg/l	N	001-002
Total Dissolved Solids	T808	F	1	mg/l	N	001-002
Suspended Solids (Total)	T2	AR	10	mg/l	N	001-002
Diss Oxygen	T7	AR	1.0	mg/l	N	001-002
Sulphate	T686	F	0.5	mg/l	U	001-002
Chloride	T686	F	1	mg/l	U	001-002
Nitrate	T686	F	0.5	mg/l	U	001-002
Nitrite	T686	F	0.1	mg/l	U	001-002
Phosphate	T686	F	0.5	mg/l	U	001-002
Ammonia expressed as NH ₄	T686	F	0.05	mg/l	U	001-002
Cyanide(Total)	T546	F	0.01	mg/l	U	001-002
Phenols(Mono)	T546	F	0.02	mg/l	U	001-002
Sodium	T6	F	0.05	mg/l	U	001-002
Magnesium	T6	F	0.1	mg/l	U	001-002
Potassium	T6	F	0.05	mg/l	U	001-002
TPH (C10-C40)	T219	AR	20	µg/l	U	001-002



Certificate of Analysis

Report Number: 631054-1

Date of Report: 15-Feb-2017

Customer: WJ Groundwater
Unit 5 Abbots Business Park
Primrose Hill
Kings Langley
Hertfordshire
WD4 8FR

Customer Contact: Mr Tom Stockman

Customer Job Reference:

Customer Site Reference: Tottenham Hotspur

Date Job Received at SAL: 03-Feb-2017

Date Analysis Started: 03-Feb-2017

Date Analysis Completed: 15-Feb-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with SAL SOPs

All results have been reviewed in accordance with Section 25 of the SAL Quality Manual



1549

Report checked
and authorised by :
Aislinn Arthey
Trainee Project Manager

Issued by :
Aislinn Arthey
Trainee Project Manager



Analysed as Water

Index to symbols used in 631054-1

Notes

Method Index

Page 2 of 3
631054-1

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
As (Dissolved)	T281	F	0.0002	mg/l	U	001-002
Fe (Dissolved)	T281	F	0.005	mg/l	U	001-002
Fe (Total)	T301	AR	0.005	mg/l	U	001-002
Mn (Dissolved)	T281	F	0.010	mg/l	U	001-002
pH	T7	F			U	001-002
Electrical Conductivity	T7	F	1	µS/cm	U	001-002
Alkalinity expressed as CaCO ₃	T22	F	20	mg/l	U	001-002
Total Hardness expressed as CaCO ₃	T649	F	10	mg/l	U	001-002
Biochemical Oxygen Demand (Allyl Thiourea)	T264	F	1	mg/l	N	001-002
Chemical Oxygen Demand	T221	F	20	mg/l	N	001-002
Total Dissolved Solids	T808	F	1	mg/l	N	001-002
Suspended Solids (Total)	T2	AR	10	mg/l	N	001-002
Diss Oxygen	T7	AR	1.0	mg/l	N	001-002
Sulphate	T686	F	0.5	mg/l	U	001-002
Chloride	T686	F	1	mg/l	U	001-002
Nitrate	T686	F	0.5	mg/l	U	001-002
Nitrite	T686	F	0.1	mg/l	U	001-002
Phosphate	T686	F	0.5	mg/l	U	001-002
Ammonia expressed as NH ₄	T686	F	0.05	mg/l	U	001-002
Cyanide(Total)	T546	F	0.01	mg/l	U	001-002
Phenols(Mono)	T546	F	0.02	mg/l	U	001-002
Sodium	T6	F	0.05	mg/l	U	001-002
Magnesium	T6	F	0.1	mg/l	U	001-002
Potassium	T6	F	0.05	mg/l	U	001-002
TPH (C10-C40)	T219	AR	20	µg/l	U	001-002



Certificate of Analysis

Report Number: 636232-1

Date of Report: 07-Mar-2017

Customer: WJ Groundwater
Unit 5 Abbots Business Park
Primrose Hill
Kings Langley
Hertfordshire
WD4 8FR

Customer Contact: Mr Tom Stockman

Customer Job Reference:

Customer Purchase Order: 000PO29995

Customer Site Reference: THFC

Date Job Received at SAL: 27-Feb-2017

Date Analysis Started: 02-Mar-2017

Date Analysis Completed: 06-Mar-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with SAL SOPs

All results have been reviewed in accordance with Section 25 of the SAL Quality Manual

SCIENTIFIC ANALYSIS
LABORATORIES



1549

Report checked
and authorised by :
Aislinn Arthey
Trainee Project Manager

Issued by :
Aislinn Arthey
Trainee Project Manager



SAL Reference: 636232 Project Site: THFC Customer Reference: Water Analysed as Water Suite A						
SAL Reference				636232 001	636232 002	
Customer Sample Reference				East Discharge	West Discharge	
Date Sampled				27-FEB-2017	27-FEB-2017	
Determinand	Method	Test Sample	LOD	Units		
As (Dissolved)	T281	F	0.0002	mg/l	0.0010	0.0008
Fe (Dissolved)	T281	F	0.005	mg/l	0.005	<0.005
Fe (Total)	T301	AR	0.005	mg/l	0.50	0.68
Mn (Dissolved)	T281	F	0.010	mg/l	0.073	0.020
pH	T7	F			7.4	7.3
Electrical Conductivity	T7	F	1	µS/cm	72	97
Alkalinity expressed as CaCO ₃	T22	F	20	mg/l	180	220
Total Hardness expressed as CaCO ₃	T649	F	10	mg/l	320	360
Biochemical Oxygen Demand (Allyl Thiourea)	T264	F	1	mg/l	2	2
Chemical Oxygen Demand	T221	F	20	mg/l	<20	<20
Total Dissolved Solids	T808	F	1	mg/l	48	65
Diss Oxygen	T7	AR	1.0	mg/l	8.5	8.3
Sulphate	T686	F	0.5	mg/l	100	87
Chloride	T686	F	1	mg/l	72	79
Nitrate	T686	F	0.5	mg/l	33	19
Nitrite	T686	F	0.1	mg/l	0.9	0.2
Phosphate	T686	F	0.5	mg/l	0.7	1.3
Ammonia expressed as NH ₄	T686	F	0.05	mg/l	0.25	0.20
Sodium	T6	F	0.05	mg/l	49	53
Magnesium	T6	F	0.1	mg/l	9.0	12
Potassium	T6	F	0.05	mg/l	16	15
Cyanide(Total)	T546	F	0.01	mg/l	<0.01	<0.01
Phenols(Mono)	T546	F	0.02	mg/l	<0.02	<0.02
TPH (C10-C40)	T219	AR	20	µg/l	<20	<20
Rapidly Settleable Solids (1 hour)	T713	AR	10	mg/l	<10	<10
Settleable Solids (24 hours)	T714	AR	10	mg/l	<10	<10
Suspended Solids (Total)	T2	AR	10	mg/l	<10	<10
Unsaponifiable Oils and Grease	T2	AR	10	mg/l	<10	<10

Index to symbols used in 636232-1

Value	Description
F	Filtered
AR	As Received
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T7	Probe
T264	Probe (Incubation Carbonaceous) (5 Days)
T714	Settled 24 hours/Gravimetric
T301	ICP/MS (Total)
T546	Colorimetry (CF)
T22	Titration
T221	Colorimetry (CE)
T649	ICP/OES (Calc)
T808	Calc (by EC)
T219	GC/FID (SE)
T281	ICP/MS (Filtered)
T686	Discrete Analyser
T2	Grav
T6	ICP/OES
T713	Settled 1 hour/Gravimetric

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
As (Dissolved)	T281	F	0.0002	mg/l	U	001-002
Fe (Dissolved)	T281	F	0.005	mg/l	U	001-002
Fe (Total)	T301	AR	0.005	mg/l	U	001-002
Mn (Dissolved)	T281	F	0.010	mg/l	U	001-002
pH	T7	F			U	001-002
Electrical Conductivity	T7	F	1	µS/cm	U	001-002
Alkalinity expressed as CaCO ₃	T22	F	20	mg/l	U	001-002
Total Hardness expressed as CaCO ₃	T649	F	10	mg/l	U	001-002
Biochemical Oxygen Demand (Allyl Thiourea)	T264	F	1	mg/l	N	001-002
Chemical Oxygen Demand	T221	F	20	mg/l	N	001-002
Total Dissolved Solids	T808	F	1	mg/l	N	001-002
Diss Oxygen	T7	AR	1.0	mg/l	N	001-002
Sulphate	T686	F	0.5	mg/l	U	001-002
Chloride	T686	F	1	mg/l	U	001-002
Nitrate	T686	F	0.5	mg/l	U	001-002
Nitrite	T686	F	0.1	mg/l	U	001-002
Phosphate	T686	F	0.5	mg/l	U	001-002
Ammonia expressed as NH ₄	T686	F	0.05	mg/l	U	001-002
Sodium	T6	F	0.05	mg/l	U	001-002
Magnesium	T6	F	0.1	mg/l	U	001-002
Potassium	T6	F	0.05	mg/l	U	001-002
Cyanide(Total)	T546	F	0.01	mg/l	U	001-002
Phenols(Mono)	T546	F	0.02	mg/l	U	001-002
TPH (C10-C40)	T219	AR	20	µg/l	U	001-002
Rapidly Settliable Solids (1 hour)	T713	AR	10	mg/l	N	001-002
Settlable Solids (24 hours)	T714	AR	10	mg/l	N	001-002
Suspended Solids (Total)	T2	AR	10	mg/l	N	001-002
Unsaponifiable Oils and Grease	T2	AR	10	mg/l	N	001-002

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