

Dawley Road, Hayes

Design Statement

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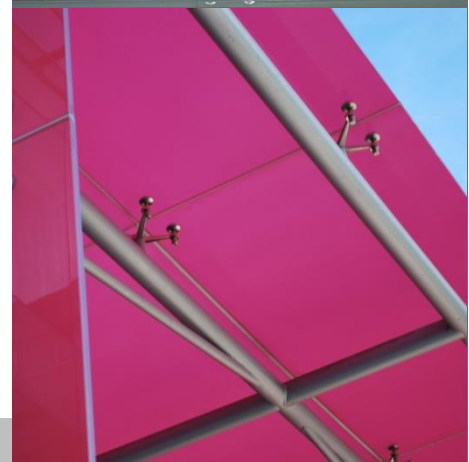
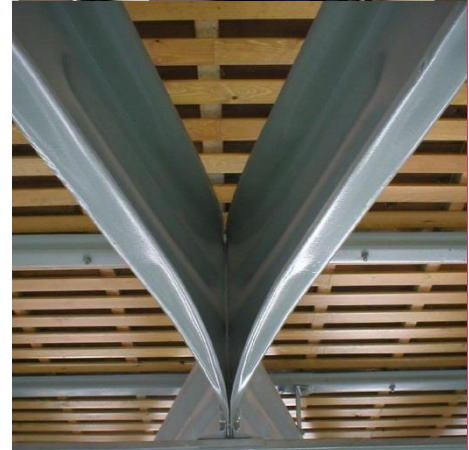
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1.0 Introduction

This Design Statement has been prepared by Curtins for Abellio's appointed Contractor to provide guidance with respect to the following aspects of work (listed below) during construction of the new bus depot at Dawley Road, Hayes.

- Management and removal of soils impacted with hydrocarbons within central-western area of the site;
- Removal of potential on-site tanks, infrastructure and sumps on-site during construction within the central-western; and;
- Contingency planning for unforeseen contamination and any potential contamination incidents.

The report has been prepared to serve as a guide for 'good practice' during development works and offer advice for potential unforeseen contamination as part of the development works, with the requirements listed below in Section 1.1.

The report is titled as a Design Statement (as opposed to a Remediation Statement) in the absence of any requirement for remedial measures for the site to be deemed 'suitable for use'. The previous ground investigation works determined a low contamination risk on-site for both human health and controlled waters, with recommendations for:

- the suspected tank/sump area with residual phase contamination is removed or inspected from the central area of the site, with surrounding soils validated to ensure no remaining gross or mobile phase sources of contamination within the unsaturated zone remain; and,
- If an underground storage tank is present, a tank removal specification is recommended to be provided to ensure no potential further release of petroleum hydrocarbon contamination.

Consequently, the Design Statement provides a method of works for the Contractor to undertake the above recommendations as part of the construction phase.

The document has also been prepared to support discharge of the respective planning conditions listed on the planning decision notice 3886/APP/2020/3751 relating to the proposed development, notably condition 18 in relation to Contaminated Land.

1.1 Particular Requirements of the Design Statement

The Design Statement is to account for the following;

- A description of the materials likely to be encountered by the developer and their sub-contractors.
- Strategy for removal and validation of hydrocarbon impacted soils within central-western area;
- Strategy for removal of potential tanks and sumps within central-western area;

- Advice with respect to classification of unsuitable materials for disposal to a suitably licensed facility.
- Strategy for dealing with unexpected contamination and contaminative incidents.

1.2 Definitions

In this document the following definitions apply,

Contractor Refers to the Principal Contractor responsible for the development works.

Site Manager Refers to a representative of the Contractor resident on site.

Engineer Refers to a suitably qualified representative from Curtins, who would not normally be resident on site.

1.3 References

The Remediation Statement has been prepared with reference to the following key reports;

- Curtins, Dawley Road, **Phase 1 Preliminary Risk Assessment**, August 2020 (Ref: 076625-CUR-00-XX-RP-GE-001)
- Curtins, Dawley Road, Hayes **Phase 2 Ground Investigation Report**, December 2020 (Ref. 076625-00-XX-RP-GE-002)

2.0 Ground Conditions

Ground conditions have been summarised below based on the findings of the Curtins Phase 2 Ground Investigation report as referenced in Section 1.3.

From earliest available mapping (1860s), the subject site had a gravel pit constructed within the eastern portion of the site, whilst the remainder of the site is covered by a part of a larger orchard. In later mapping both of these were infilled. By 1914, the site has developed into a small holding with several structures in the eastern portion of the site and an area of marshland and osiers in the centre of the site. In later mapping, there is a period of demolition and re-constructions on-site until circa 2010 when the structures comprising the current day configuration. The site was historically listed as a pig farm and engineering works, with likely informal works uses not fully detailed.

2.1 Potential Storage Tanks

A suspected above ground storage tank area has been identified within the western area of the site, as presented in Figure 2.1.1a. Within this area, two brick structures had been demolished to ground level, however signage remaining on the access door detailed a 'no smoking sign' (as presented in Figure 2.1.1a). In addition, on the southern corner of the brick structures is a metal (potential road) plate which was noted (as presented in Figure 2.1.1b) to sound 'hollow' underneath. The possibility exists for a potential sump or underground storage tank area within the site.

As a result of this, an information request in regard to petroleum records was submitted to the London Fire Brigade (LFB). However, there was no information with regards to petroleum records (be it above or below ground storage) held for the site by the LFB. The possibility for an informal fuel storage area on-site (installed by the farm without LFB knowledge) cannot be discounted. In addition, no pumps or filling points were encountered within this area.



Figure 2.1.1a Location of suspected Above Ground Storage Tank Area (highlighted in red)



Figure 2.1.1b *Location of potential underground storage tank area (highlighted in red)*

2.2 **Made Ground**

Made Ground deposits were encountered in all exploratory locations to maximum base depths ranging from 1.00m (eastern portion) to 3.30m bgl (central portion), consisting of hard-standing at surface, with a sub-base and soft cohesive fill encountered thereafter. Anthropogenic material of the Made Ground comprised black flint, brick, concrete, asphalt, ceramic, metal, wood, burnt material and aggregates with occasional cobbles.

Hydrocarbon odours were noted within the Made Ground, considered to comprise solid phase material ash/aggregate. The majority of hydrocarbon odours within Made Ground soils were recorded adjacent to the suspected tank location on-site (central portion).

2.3 **Natural Deposits**

The Superficial Deposits, which comprised granular material of Lynch Hill and Boyn Hill Gravel Member, were encountered to underlie the Made Ground and comprised medium dense to dense yellowish orangish brown slightly clayey SAND and GRAVEL. The unit was locally absent within WS204 (far western portion). The unit was encountered to base depths of 3.50m (western portion) and 6.50m bgl (eastern portion). No visual or olfactory indicators of contamination were encountered within the superficial deposits.

Thereafter Bedrock geology of the London Clay Formation was encountered to termination depths of 12.00m bgl (base not encountered) comprising initially a firm to stiff, orange brown, silty CLAY to circa 7.00m bgl with stiff to very stiff grey slightly silty CLAY thereafter

2.4 Groundwater

During the ground investigation, groundwater seepages were encountered across the site within the Made Ground at depths ranging from 1.00m bgl /37.78m AOD (WS104 – central portion) to 1.65m bgl/37.47m AOD (WS101) in October 2020. The additional ground investigation works in November 2020 recorded seepages at 0.80m bgl/37.90m AOD (WS201 and WS207) to 1.30m bgl/37.60m AOD (TP201).

During the ground investigation visual and olfactory indicators of mobile phase contamination were encountered within shallow groundwater adjacent to the suspected tank area. The indicators comprised hydrocarbon sheens and odours within groundwater.

2.5 Contamination Concentrations

High concentrations (>1,000mg/kg) were recorded for TPH Aliphatic EC12-EC16, EC16-EC21 and TPH Aromatic EC16-EC21 in samples taken from the Made Ground, where both visual and olfactory indicators of contamination were noted and considered to be within the potential former tank area. This is most likely reflective of the mobile phase contaminants encountered during the ground investigation within these two locations with the TPH ranges reflective of diesel and petrol fuel source.

A total of 22 samples were submitted to the laboratory for Asbestos presence and screen. The results of the testing identified Asbestos within a single sample (WS205 at 0.20m bgl) comprising Amosite – Loose Fibres. Following the positive Asbestos detection, quantification testing was undertaken to determine percentage of Asbestos within the sample, which recorded <0.001 and consequently not above the hazardous waste threshold (>0.1%).

The environmental chemistry soil results have been compared with the Generic Assessment Criteria (GAC) for soils with respect to human health against '*Commercial*' thresholds.

With respect to the proposed end-use of the site, no exceedances of Commercial screening criteria were recorded within soils or groundwater, in regard to the inhalation of vapour contaminant pathway.

Within WS105, several exceedances of TPH Aliphatic EC10-EC35 were recorded within groundwater on the two visits which is considered to be due to presence of mobile phase contamination within this area and the locations proximity to suspected tank on-site. It is evident that encountered dissolved phase contamination within groundwater of WS105 is residual and not evident of a wider source. It is considered that as a result of groundwater sampling no ongoing spillage and leakage of potential tanks is ongoing, this is contributed to concentrations of less than MDL of installations surrounding the potential former tank area. In addition, all other locations recorded TPH and BTEX less than laboratory

MDL including those located closest to northern, eastern, southern and western boundaries. Based on this, it is considered unlikely that such concentrations are migrating off-site to present a risk to wider groundwater. Given the prevailing commentary, it is considered the presence of mobile phase contaminants within the central portion (WS105) are unlikely to present a risk to wider groundwater.

2.6 Ground Gas

Ground gas was monitored on three occasions to date as part of the Curtins ground investigation.

Maximum concentrations of carbon dioxide and methane were recorded at 4.9% vol/vol (WS101) to <0.1% vol/vol, respectively. These ground gas concentrations are consistent with the on-site ground gas sources, i.e. predominately Made Ground less than 3.30m in thickness predominately consisting of inert material (i.e. brick, and concrete), high groundwater table and limited organic/putrescible material recorded. Gas flow rates did not exceed 0.01 l/hr during the three gas monitoring visits.

Based on the existing results recorded to date, the ground gas regime at the site has been assessed to be Characteristic Situation 1 (very low risk) as detailed in BS 8485:2015.

3.0 Overview of Development Works

The proposed development (Appendix A) is to comprise a single two-storey welfare/accommodation building with areas of parking of buses, fuel station and wash facilities. The welfare/accommodation building is proposed within the north-eastern area, within footprint of current two storey building on-site.

With reference to the Curtins Phase 2 investigation, no specific remedial actions were recommended for the site to be deemed 'suitable for use'. Only recommendations for 'betterment' of the suspected tank area and removal of residual phase contamination within soils to reduce any further mobilisation of petroleum hydrocarbons within the Principal Aquifer.

It was subsequently recommended that a Design Statement was prepared to provide a scope of works for:

- i) The removal of residual phase contamination is removed or inspected from the central portion of the site (within the suspected tank/sump area), with surrounding soils validated to ensure no remaining gross or mobile phase sources of contamination within the unsaturated zone (i.e. above groundwater) remain; and,
- ii) The removal of any tanks, infrastructure or sumps if present within the central area of the site, to ensure no potential further release of petroleum hydrocarbon contamination.

In practice, this will comprise three key actions;

- Development Action 1:** Removal of hydrocarbon impacted soils above groundwater surrounding the suspected tank area (central area).
- Development Action 2:** Removal of suspected tank, infrastructure and/or sumps which may be conduits for hydrocarbons.
- Development Action 3:** Provision of guidance relating to contingency planning for unforeseen contamination and any potential contamination incidents.

Guidance on these three actions is provided within the following sections.

3.1 Development Action 1 – Removal of Hydrocarbon Impacted Soils – Central Area

As determined within Curtins Phase 2 reporting, concentrations of TPHs have been identified within the area of a suspected tank/sump area. The recent investigation has identified residual hydrocarbon impacted soils which require removal to improve local groundwater quality and reduce further the mobilisation of petroleum hydrocarbons within the Principal Aquifer.

The location of the suspected tank area is to be excavated and the excavation will be inspected and validated by a suitably qualified Engineer.

Visually contaminated soils shall be removed from the excavation, stockpiled in a bunded area on an impermeable surface (e.g. visqueen-sheeting) and covered by an impermeable surface (e.g. visqueen-sheeting) to prevent any potential contamination migration or cross contamination, in preparation for off-site disposal to a suitably licenced facility.

During temporary stockpiling of impacted material the soils will be stored so as to minimise the potential for odour nuisance to adjacent site residents and prevailing weather conditions be monitored by the Contractor. As a minimum stockpiles shall be covered with sheeting at the end of each working day to prevent migration of odours to off-site receptors. The contractor shall put in place a suitable environmental monitoring programme and take into account prevailing weather conditions to prevent nuisance and to prevent excessive wetting and potential leachate generation of the stockpile.

As a minimum stockpile shall be covered with sheeting at the end of each working day and during periods of heavy rainfall.

3.1.1 Soil Validation

The horizontal extent of the excavation will be progressed based on the presence of visual and olfactory indicators of hydrocarbon contamination. When visual or olfactory indicators are no longer apparent samples will be collected from the excavation extent at a frequency of 1 sample per 25m², to include as a minimum, one sample from each side of the excavation and one from the base, and tested for the suite of analysis outlined in Table 3.1. Results will be compared to the thresholds for human health (Commercial).

The vertical extent of the investigation will be progressed to either the base of contamination (based on visual or olfactory indicators) or, the groundwater table (considered to be circa 1.0m to 1.20m bgl within the central-western area).

Where the excavation ceases above the groundwater validation samples will be collected at a frequency of 1 sample per 25m², to include as a minimum, one sample from each side of the excavation and one from the base.

The contaminants of concern potentially present within the vicinity of the works are considered to include: total petroleum hydrocarbons (TPHs), benzene, ethylbenzene, toluene and xylene (BTEX), VOCs and lead.

Table 3.1 - Environmental Chemistry Analysis Suite : Soils

Suite Ref.	Analyte	LOD
Soils Suite	Benzene, Ethylbenzene, Toluene & Xylene	2 µg/kg
	Lead	5 mg/kg

	TPH (Aro/Alk Split)	0.01 to 0.1 mg/kg
	VOCs	0.01 mg/kg

Analytical results will be compared to Generic Assessment Criteria (GACs) applied in the Curtins Phase 2 Ground Investigation to determine whether they can remain in-situ or whether treatment/disposal options will be required.

The Contractor should allow and arrange for suitable testing (e.g. Waste Acceptance Criteria (WAC) testing) of the stockpiled soils to be removed from the site to determine their waste classification.

The amount of soils required to be removed from the excavation and stockpiled within a separate area of the site is to be determined by the Engineer.

3.2 Development Action 2 - Strategy for Removal of Underground Storage Tanks (UST)

At this stage, there is considered potential for unrecorded underground storage tanks, infrastructure and sumps on-site which would require removal if present. The suspected area is highlighted in Figure 2.1 and provided within a drawing in Appendix A, however given the history of the sites other tanks may be encountered.

The following strategy should be adopted when removing underground storage tanks and infrastructure.

Each of the tasks in table 3.2.1 should be undertaken. Each task is summarised, with further detail provided in the subsequent sections.

Table 3.2.1 Tasks for removal of underground storage tanks.

Task Number	Task Title	Task Description	Performance Specification Section
1	Preliminary Excavation and Inspection	Inspection of surface inspection and fill points to determine status of tanks. Controlled excavation via toothless bucket to minimise spark potential and/or damage to USTs.	3.2.1
2	Draining and Removal	Potential flushing, draining and removal of UST associated pipework if found to contain residual fuels.	3.2.2

Task Number	Task Title	Task Description	Performance Specification Section
3	UST Draining and Degassing/Inerting (If Voids Present)	If voids found to be present, gas testing to be undertaken to determine extent of vapours present. Potential degassing if vapours found to be considerable or if USTs found to not have been decommissioned.	3.2.3
4	Additional Excavation and Removal of Anchors	Additional excavation to expose sides of tank and potential anchor points.	3.2.4
5	Destruction of Tanks On-Site	Destruction of the USTs in-situ via cold cutting methods.	3.2.5
6	Soil and Groundwater Remediation	Validation of potentially contaminated soil/groundwater within vicinity of UST farm and potential removal of impacted soils/groundwater.	3.2.6

3.2.1 Preliminary Excavation & Inspection

Exposing USTs

The Contractor shall saw cut and remove any concrete or asphalt pavement located above the USTs, sufficient as such to allow for the subsequent removal of the USTs.

Controlled excavation (i.e. in maximum of 300mm layers) should be conducted to expose the tops of the tanks, access points, fuel and vent lines. Excavations should be undertaken with a toothless bucket to minimise any spark potential, potential damage to the USTs and/or associated pipework.

During the excavation and removal of each of the underground fuel storage tanks, it should be assumed that contaminated materials/soils are likely to be encountered within areas immediately surrounding the tank, pipework, oil/water separators and bowsers.

Inspection

Once the USTs are exposed, all visible inspection points should be opened and inspected (following testing, discussed below). If such activity is not physically possible, cold cutting of the lids and/or cold-drilled pilot holes should be undertaken within areas of suspected voids.

Upon consultation with the Engineer, gas testing inside the inspection points and pilot holes should be undertaken to determine the potential presence of vapours within the USTs.

3.2.2 Pipework Draining & Removal

Removal of Residual Hydrocarbon from Fuel Lines

Before any work is carried out to render a UST safe for removal, all residual product from associated pipework must be removed. To date no information is available as to the decommissioning status of the tanks or potentially fuel lines.

The Contractor shall locate the non-return valve fittings on the suction line and remove the non-return valve poppet (ensuring minimal product spillage) to allow for any remaining product in the suction line to drain back to the UST. Where there is no non-return valve, or if the non-return valve is unserviceable, all remaining product in the suction line shall be removed in an appropriate manner to minimise spillage of fuel onto the ground.

Allowance should be made for the draining/flushing and removal of fuel lines from the site. If draining of fuel lines is required, appropriate collection measures and spill kits should be utilised to ensure no fuel product is discharged to ground and the subsurface as referenced within the Association for Petroleum and Explosives Administration (APEA) guidance document.

The following general provisions must be adhered to:

- ‘Cold cutting’ is the only acceptable method of cutting fuel lines; and
- Under no circumstances shall the Contractor use non-spark proof implements to force any of the tank top fittings.

Pipework Removal

All primary and secondary product pipework within the vicinity of the tanks are to be removed via excavation to ensure the stages of works can be advanced. Extreme care should be exercised during this activity using appropriate materials to contain any liquids encountered as per APEA guidance document.

All associated vent lines, vapour recovery and/or unexpected piping (if present) are also to be removed from the site.

3.2.3 UST Draining and Inert/Degassing

Removal of Residual Hydrocarbon from USTs

Should residual hydrocarbons be encountered within any of the tanks on-site, the following procedure should be adhered to:

- The Contractor shall dip the UST to quantify the amount of residual hydrocarbons within the tank;
- Following the completion of residual fuel removal from the suction line(s), as described in Section 10.2, the Contractor should introduce water into the USTs to permit ‘scavenging’ of the last remaining quantities of hydrocarbons present;
- The Contractor should ensure that the water hose touches the bottom and be electrically bonded to the UST;
- The Contractor should remove the contents of each UST using an appropriately licensed liquid waste removal Contractor and the suction hose during removal should be electrically bonded to the USTs during the liquid transfer.
- The Contractor shall complete waste transport certificates for all fluids disposed from the site, the copies of which are to be presented to the Engineer upon completion of the works to incorporate within a Validation report.

Inerting/Degassing of USTs

If voids are present, prior to any further works, gas testing and inerting of the UST is required. This task should only be carried out by a competent person, who will be able to select the appropriate equipment and understand its limitations.

On completion of the test, documentation detailing the date and time of the test, the appropriate meter readings and the duration of the ‘safe period’ should be presented to the Engineer.

For all inerting methods, except hydrophobic foam, the tank atmosphere will only remain safe for a limited period.

Figure.3.2.3 identifies potential inerting methods with monitoring requirements as per APEA guidance document.

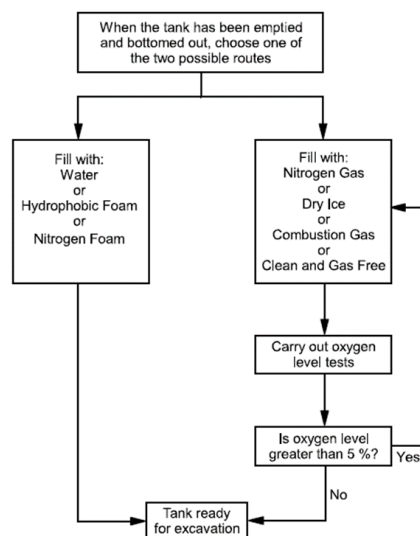


Figure 3.2.3; Schematic to prepare tank for excavation

There are several known methods for inerting/degassing tanks, examples of which are presented in Table 3.2.3:

Table 3.2.3: *Methods for preparing tank for excavation.*

Method	Description
Hydrophobic Foam	Foam with a designed compressive strength of 8 tonnes/m ² is generated on site and pumped directly into the tanks(s) via the fill point. It should be noted that foam of this density is appropriate for inerting tanks for a period not exceeding six months. This procedure should only be carried out by an appropriately licensed contractor.
Nitrogen Foam	High expansion foam is produced in a generator using nitrogen, water and a detergent foam compound, and then introduced into the tank via the fill pipe. Unless the tank had been filled with nitrogen foam it will be necessary for a competent person to test the atmosphere inside the tank to ensure oxygen levels have been reduced below 5%.
Nitrogen Gas	Nitrogen is passed continuously into the tank at certain point, causing the air and vapour to be purged from another opening (exhaust outlet) within the tank, remote from the first point, in a safe position. This will usually be the vent pipe flame trap outlet. The tank should be 'bottomed out' and all openings sealed except those required for the inlet of nitrogen and for the exhaust outlet (vent pipe) to the atmosphere. The nitrogen should then be introduced and the mixture leaving the tank should be vented to the atmosphere so that the tank remains at atmospheric pressure throughout the entire operation. Care should be taken to ensure the gas is not

Method	Description
	introduced at a faster rate than it can escape through the outlet. The atmosphere within the tank should be tested using an oxygen meter and purging continued until a level of less than 5% is achieved. Following completion of the purging, the openings of the tank should be sealed and the tank excavated. If excavation of the tank takes place immediately after purging, a small vent may be left on the tank to allow any small excess pressure to escape. During the excavation and removal, any holes found in the tank should be securely plugged. Where holes are found it may be necessary to retest the atmosphere to check the level of inerting.
Water Fill	Water filling USTs is only considered a decommissioning method should tanks remain in-situ. As this is not possible, this methodology is not considered further.
Dry Ice	This method should only be carried out by an appropriately licensed contractor. Hazards can occur due to ineffective inerting because of stratification of the cold dense carbon dioxide, the insufficient charge of dry ice or the incomplete conversion to gas. To check the effectiveness of this method, it is necessary to test the atmosphere within the tank with an oxygen meter. Following the bottoming of the tank, the vent pipes should all be removed and all openings sealed except the one required for the insertion of dry ice. At least 2kg of dry ice for each cubic metre of tank volume should be allowed. The dry ice should be used in pellet form or blocks broken down into pieces no larger than 3cm in diameter. Operatives should wear appropriate PPE when handling and if blocks are being broken down, they should be covered to contain any fragments. A competent person should then test the atmosphere of the tank to ensure oxygen levels are below 5%. Care should be taken to ensure that the short-term exposure limit to carbon dioxide is not exceeded whilst working within the vicinity of a tank that has been purged with dry ice. During the excavation/removal any holes found in the tank should be securely plugged.

3.2.4 Additional Excavation and Removal of Anchors

Additional excavation will be required to expose the sides and ends of the UST to allow for the safe controlled demolition. This should again be conducted in 300mm intervals, with a toothless bucket where practicable, to mitigate damage to the tanks and/or associated infrastructure.

The potential presence of shallow groundwater could mean that the USTs were installed with 'dead man' anchors or maybe cased in concrete. If so, allowance should be made for the safe

removal of the 'dead man' straps or the additional breakout of concrete would need to be considered. Figure 3.2.4 below shows an example of dead man anchors holding down a UST.

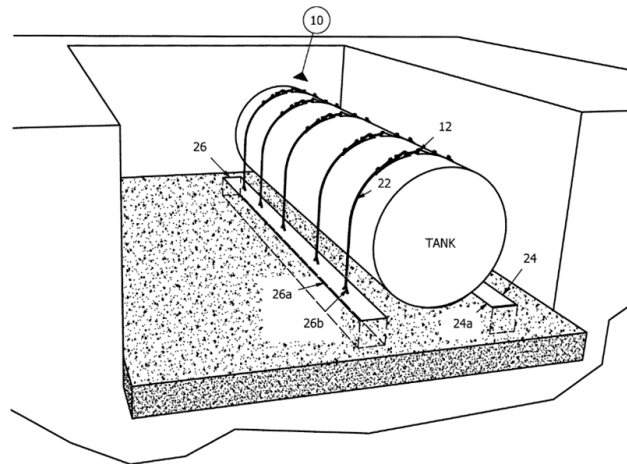


Figure 3.2.4 Example of 'dead man; anchor

3.2.5 Destruction of Anchors on-site

Destruction of Tanks

If there is sufficient space (following demolition of on-site buildings) on the site to carry out the work safely, if considered appropriate for the redundant tanks to be broken up at the site prior to disposal.

Prior to undertaking these works it is necessary that a competent specialist contractor carry out a risk assessment (including environmental risk) to ensure that dismantling can be undertaken without endangering either workers or the public. To minimise the risk of fire or explosion, only cold cutting should be used.

If voids are encountered within the tanks during this process, works should be stopped, with the voids inspected and gas tested to determine whether inerting of the potential void is required. This should be completed to the satisfaction of the Engineer.

Disposal

Disposal of scrap metals and any residual foam contents from the tanks should be handled and disposed by an appropriately licensed contractor. Upon removal and disposal from site, all waste transfer certificates are to be collected and provided to the Engineer.

3.2.6 Soil and Groundwater Remediation

Upon removal of the USTs and associated infrastructure, the excavation will be inspected and validated by a suitably qualified Engineer.

Visually contaminated soils shall be removed from the excavation and stockpiled on-site on top of appropriate visqueen-sheeting to prevent any potential contamination migration, in preparation for off-site disposal.

Representative soil samples will be obtained from a suitably ordered grid pattern within the excavations and based on field observations scheduled for laboratory chemical analysis. A minimum of one sample per face of excavation or minimum of one per 25m² whichever is greater. The laboratory selected will have appropriate UKAS and MCERTS accreditations.

Soil Validation

The contaminants of concern potentially present within the vicinity of the works are considered to include: total petroleum hydrocarbons (TPHs), benzene, ethylbenzene, toluene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), Volatile Organic Compounds (VOC).

Table 3.2.6 *Environmental Chemistry Analysis Suite : Soils*

Suite Ref.	Analyte	LOD
	Benzene, Ethylbenzene, Toluene & Xylene	2 µg/kg
	VOC	0.01 mg/kg
	PAHs (USEPA 16)	0.1 mg/kg
	TPH CWG (Aro/Alk Split)	0.01 to 0.1 mg/kg

Analytical results will be compared to Generic Assessment Criteria (GACs) determined by the engineer, and based on the intended re-use of the soils, to determine whether they can remain in-situ or whether treatment/disposal options will be required. Soils with gross visual evidence of contamination must be removed from site as a betterment approach to groundwater contamination.

The Contractor should allow and arrange for Waste Acceptance Criteria (WAC) testing of the stockpiled soils to be removed from the site to determine their waste classification.

The amount of soils required to be removed from the excavation and stockpiled within a separate area of the site is to be determined by the Engineer.

Contaminated Groundwater

There is a potential for groundwater and/or perched waters to be encountered during the excavation post-tank removal. Any visual and/or olfactory evidence of residual product within perched waters present in the tank pit will be assessed by a suitably qualified Engineer.

Should perched waters be determined to contain visible Light Non-Aqueous Phase Liquid (LNAPL) and/or high levels of dissolved phase contamination, an allowance should be made for the potential removal and treatment of the contaminated waters via a suitably qualified contractor, with subsequent off-site disposal to a licensed wastewater treatment facility.

The extent of encountered groundwater requiring removal should be undertaken until no visible product and/or significant sheens are present; to be determined by the Engineer.

Copies of all relevant waste transfer certificates should be supplied upon completion of the works in support of the proposed verification report.

3.2.7 Verification Report

Upon completion of the site works the Contractor should supply the Engineer with all the relevant documentation including all waste transfer certificates associated with this scope of works.

The supervising engineer is to prepare a verification report detailing the works undertaken along with any testing results, waste transfer tickets etc. Section 6.0 detail further validation requirements which are to be adhered to.

3.2.8 Health & Safety

This section details UST removal specific health and safety requirements, but does not seek to cover all aspects to be managed by the Contractor under CDM Regulations and detailed in Method Statements.

The works are likely to generate soils, dust, groundwater and other materials that may be impacted with petroleum hydrocarbons and other related chemicals. The Contractor shall incorporate in its health and safety plan provisions for protecting personnel from physical and chemical hazards associated with these materials. The health and safety plan should also incorporate personnel decontamination requirements and facilities.

Contractor Method Statements

The Contractor is required to prepare method statements relating to the separate tasks highlighted and provide these to the client or Principal Designer along with the Engineer for review prior to the commencement of the related works.

The Contractor shall induct all its employees and subcontractors into the relevant aspects of their health and safety plan and method statements prior to each employee and/or subcontractor commencing works on site.

No works shall commence until the clients' nominated Principal Designer has approved the task specific method statement.

Explosion Risk

Of primary concern is the potential for explosion throughout the proposed removal works, including the associated pipework removal.

An explosion could be caused through the introduction of an ignition source to vapours which are potentially present within the voids of the tanks or pipework. Tanks should be treated as containing vapour rich voids and therefore potentially explosive until proven otherwise.

This assumption drives every aspect for the safe removal and destruction of the tanks.

Excavation & Other Works

Before commencement of any excavation or other works, the following minimum precautions should be observed:

- Inspection of the USTs/pipes to confirm decommissioned/degassed status;
- Clearance of other services;
- Appropriate 'Danger' notices displayed and exclusion 'work' zone enforced;
- Exclusion of ignition sources within the work zone;
- Provision of a water supply hose/mist to damp down the immediate area to reduce the risk of spark generation (moderated to minimise contaminant migration); and
- Exclusion of personnel from the immediate worksite except for those directly involved with the phase of works.
- The above listed precautions do not override other precautions that will need to be covered by the Contractor's overall Health and Safety Plan, aspects such as firefighting, PPE, excavation stability/shoring (if required) etc.

3.2.9 Environmental Controls

Environmental Controls are the responsibility of the Contractor. However, in general this section details specific requirements for UST removal and is not intended to cover all aspects to be managed by the Contractor and detailed within their Method Statements.

Without limiting the Contractor's obligations, it shall be their responsibility to comply with all applicable laws, regulations and rules relating to potential contamination with particular regard to:

- Surface water run-off
- Airborne particulates/vapours/odour; and
- Control of spillage.

Method statements are to be provided to the Engineer and should incorporate the environmental management measures pertaining to the above factors, with further detail given below.

Surface Water Run-Off

The Contractor is responsible for ensuring that site surface water run-off does not leave the site.

The Contractor is to provide for necessary surface water diversion systems as required to keep the construction area free from excess surface or groundwater that may interfere with the works.

All personnel engaged by the Contractor should be trained in response techniques (e.g. use of absorbent materials, etc.) to ensure that any surface water run-off with fuel leakage impact or associated potentially contaminated soil is managed appropriately.

Airborne Particles/Vapour/Odour

The Contractor is responsible for the implementation of dust suppression in work areas, using water or other means of suppression that are not considered harmful to the environment. The Contractor should also set out procedures for the mitigation of any potential odours that may arise from exposed contaminated soils that could affect off-site users (adjacent residents).

Control of Spillage

During the phase of works, any type of spillage (including fabricating, hydraulic oils, fuels and/or other materials) should be immediately contained, removed and disposed of, with any further surrounding areas cleaned.

4.0 Strategy for Handling Potentially Contaminated Soil on Site

This section relates to **Development Action 3** as identified within Section 3.0.

4.1 Unexpected Contamination

Based on the findings of the Phase 2 Ground Investigation, the likelihood of unexpected contamination existing on site is considered to be low however cannot be discounted entirely, e.g. possible borrow pits. In the event that material is revealed on site of a nature that does not accord with the previously observed and recorded descriptions the following procedure is to be complied with.

- a) Cease and make safe all excavations in this location and report observations to the Site Manager.
- b) The Site Manager is to notify the Engineer.
- c) Under guidance of the Engineer take representative samples of the suspect materials and forward to a suitably accredited laboratory for analysis.
- d) Await Engineers instructions with respect to re-commencement of the works and or removal from of suspect material to a suitably licensed disposal facility (following guidance outlined in Section 4.2 below).
- e) Local Authority and if relevant the Environment Agency are to be kept fully informed of any site such occurrences.

Advice with respect to Potentially Contaminative Incidents is presented in Section 5.0.

4.2 Contaminated Soils

In the unlikely event that contaminated soils are identified, soils should be loaded onto a lorry, covered securely and transported to the landfill facility immediately.

Where stockpiling is unavoidable the stockpile should be located on an impermeable membrane and be covered also with a low permeability membrane at the end of each working day. Where soils are wet when excavated, measures should be taken to ensure there is no runoff from the soils onto the surrounding soils.

Duty of Care: Under his duty of care, the Principal Contractor shall ensure the proper and safe disposal of waste from each site after it has been passed on to another party. In this respect details of the landfill facility to be used and the company disposing of the waste with regards to hazardous (special) and non-hazardous waste shall be provided to the Site Manager. Copies of Consignment Notices for special waste and Waste Transfer Notes for hazardous and non-hazardous waste shall be kept on site for review by Curtins.

5.0 Strategy for Potentially Contaminative Incidents

This section relates to **Development Action 3** as identified within Section 3.0.

5.1 General

Based on the evidence presented within the Phase 2 Ground Investigation including the historical uses of the site, the likelihood of unexpected sub-structures existing on site is assessed as very low.

Although considered unlikely it is possible that unknown/unrecorded substructures exist which if ruptured may release materials that could contaminate the surrounding soils and groundwater (petroleum hydrocarbons, solvents, for example).

In addition, given the sites history as a pig farm, there is a potential for animal caracasses to be buried on-site. However, none were identified as part of the ground investigation.

In the unlikely event that this occurs an outline strategy is detailed below.

5.2 Outline Strategy

Where such a tank/pipework is damaged during excavation and the contents are released into the surrounding soil, the tank/pipework should be immediately pumped dry into another suitable container and a trench with a low permeability base formed around the tank/pipework to prevent seepage laterally and to collect the contaminant. Where groundwater is encountered in the trench, it should be pumped into a suitable container and tested for the contaminant. All soils affected shall then be tested and removed from site as appropriate.

Where the damage is caused to the underside of a tank and seepage is vertical, the contaminants may present a risk of polluting the groundwater. In this instance and subject to the findings of a risk assessment boreholes may be required to prove and intercept the contaminant. The contaminant will then be pumped into suitable containers. The Engineer shall approve all proposals for such remediation.

5.3 Animal Carcasses

In the event of encountering an animal carcass on-site during construction works, it is recommended that works within the area cease and notification to the Animal and Plant Health Agency (APHA) to allow for removal.

6.0 Completion Reporting

A Completion Report will be required on completion of the works confirming that the development works have been completed satisfactorily. The Completion Report should be included within the Health and Safety Plan for the site.

The report will contain information including the following:

- Descriptive record of the works undertaken;
- Photographic evidence and details in regard to the removal of the impacted soils surrounding the former USTs on-site;
- Laboratory analysis certificates for validated and tested soils, groundwater, site won and imported materials against the testing frequencies and suites detailed herein.
- Interpretive commentary and details of any responsive actions in regard to tested data together with discussions with the local planning authority, where necessary;
- Photographic evidence of a suitable thickness of clean, soft cover having been provided to the landscaping area;
- Photographic evidence of the adopted full radon protective measures for the development;
- Waste transfer notes or consignment notes for all materials disposed off-site;
- Confirmation that the Remedial Actions were completed satisfactorily; and,
- Details of any unsuspected contamination encountered, or potentially contaminative incidents and measures taken. Confirmation that no unsuspected contamination was encountered or that no potential contaminative incidents occurred will be required.

Appendices

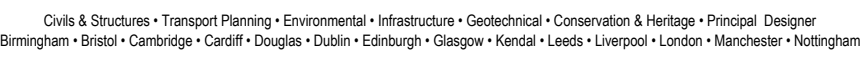
Appendix A Drawings

Appendix B Screening Criteria

Appendix A Drawings

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.

- Key**
-  **CP** Cable Percussive Borehole
 -  **TP** Machine Excavated Trial Pit
 -  **SA** Soakaway Test
 -  **CBR** In-Situ CBR Testing (using TRL Probe)



Exploratory Hole Location Plan

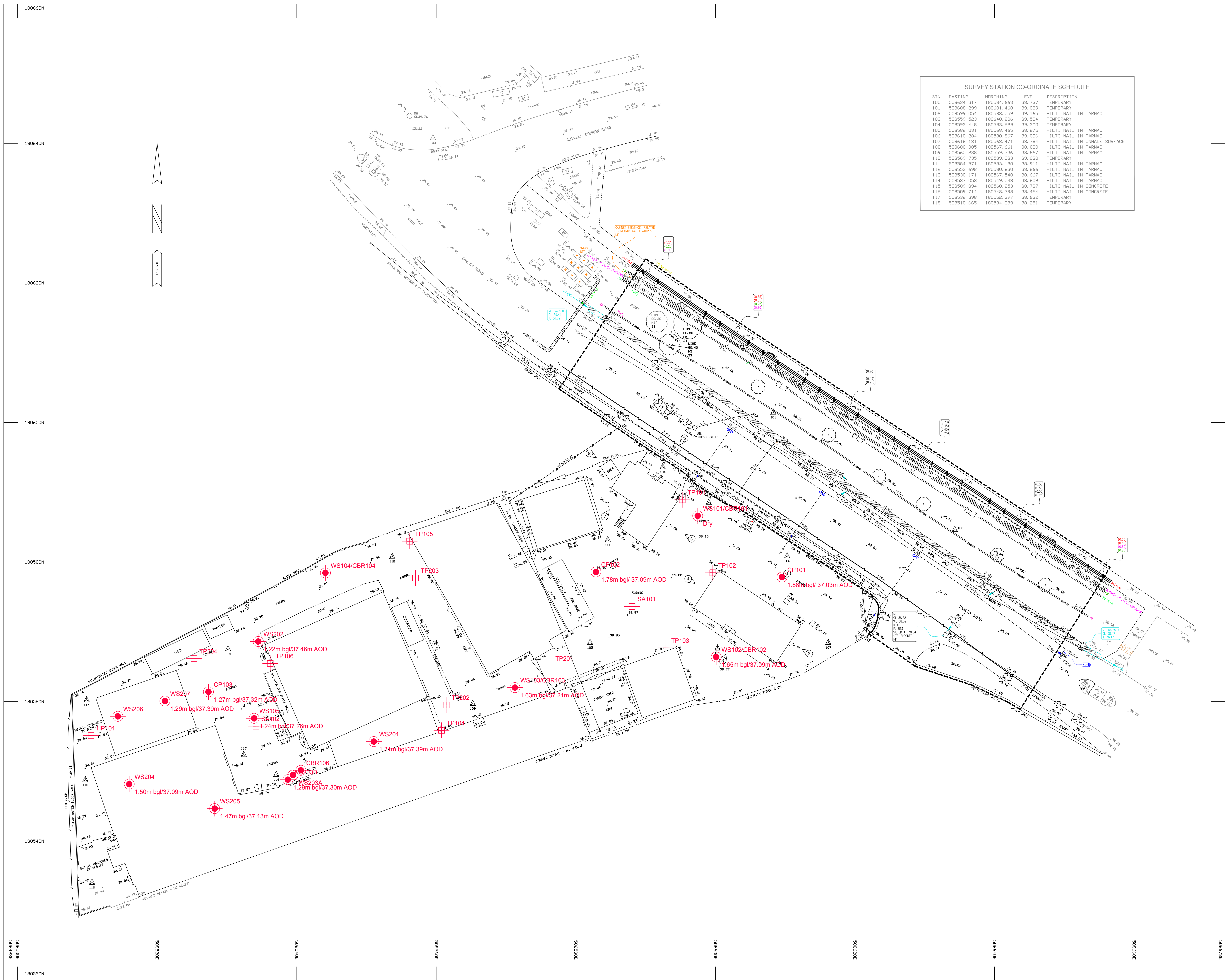
076625 - CUR - 00 - XX - DR - GE - 0001 - V01

GENERAL NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
3. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4. FOR GENERAL NOTES REFER TO DRAWING.

Key

- CP Cable Percussive Borehole
- TP Machine Excavated Trial Pit
- SA Soakaway Test
- CBR In-Situ CBR Testing (using TRL Probe)



Rev: Description: Date: By: Chk:

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Civil & Structural Engineering
Environmental Engineering
Geotechnical Engineering
Infrastructure Engineering
Process Engineering
Transport Engineering
Water Engineering
Energy Engineering
Marine Engineering
Agricultural Engineering
Mining Engineering
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Healthcare Engineering
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Marine Engineering
Agricultural Engineering
Mining Engineering
Manufacturing Engineering
Healthcare Engineering
Education Engineering
Government Engineering
Private Engineering
International Engineering
Global EngineeringProject:
Dawley Road, HayesDwg Title:
Groundwater Level Plan - 02/12/20

Size:	Date:	Drawn By:	Designed By:	Checked By:
A0	26/11/2020	WS	WS	ML
Scale:	Originator:	Volume:	Level:	Type:
076625 - CUR	- 00 - XX - DR - GE -	0004	- V01	

Appendix B Screening Criteria

Adopted Soil Generic Assessment Criteria
Sandy loam with 6% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 21	6 21	1.8 170	33 49	7.7 21	220 250
Lead	200	310	80	2,300	630	1,300
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130⁽¹⁰⁾	180⁽¹⁰⁾	53⁽¹¹⁾	980⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 79	170 170
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₆	160	160	3900	12000	600000	180000
EC ₅₋₆ - EC ₈	530	530	13000	40000	620000	320000
EC ₅₋₈ - EC ₁₀	150	150	1700	11000	13000	21000
EC ₁₀₋₁₀ - EC ₁₂	760	770	7300	47000	13000	24000
EC ₁₂₋₁₂ - EC ₁₆	4300	4400	13000	90000	13000	26000
EC ₅₋₁₆ - EC ₃₅	110000	110000	270000	1800000	250000	490000
EC ₃₅₋₃₅ - EC ₄₄	110000	110000	270000	1800000	250000	490000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₇	300	1400	57	86000	56000	92000
EC ₅₋₇ - EC ₈	660	3900	120	180000	56000	100000
EC ₅₋₈ - EC ₁₀	190	270	51	17000	5000	9300
EC ₁₀₋₁₀ - EC ₁₂	380	1200	74	34000	5000	10000
EC ₁₂₋₁₂ - EC ₁₆	660	2500	130	38000	5000	10000
EC ₅₋₁₆ - EC ₂₁	930	1900	260	28000	3800	7800
EC ₂₁₋₂₁ - EC ₃₅	1700	1900	1600	28000	3800	7900
EC ₃₅₋₃₅ - EC ₄₄	1700	1900	1600	28000	3800	7900
Aliph + Arom EC >44-70	1900	1900	3000	28000	3800	7900
Aromatic						
Benzene	0.33 0.87	1.0 3.3	0.07 0.18	95 98	73 140	110 230
Ethyl benzene	350	840	90	2800⁽⁸⁾ [66000]	2800⁽⁸⁾ [25000]	2800⁽⁸⁾ [27000]
Toluene	610	2700	120	4400⁽⁸⁾ [190000]	4400⁽⁸⁾ [56000]	4400⁽⁸⁾ [100000]
Xylene ⁽⁹⁾	230	290	160	2600⁽⁸⁾ [32000]	2600⁽⁸⁾ [43000]	2600⁽⁸⁾ [31000]
Phenol	420	520	280	3200⁽¹⁴⁾ (38000)	3200⁽¹⁴⁾ (10000)	3200⁽¹⁴⁾ (9300)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	13	13	24	1100	4900	3000
Acenaphthylene	920	6000	160	100000	15000	30000
Acenaphthene	1100	6000	200	100000	15000	30000
Fluorene	860	4500	160	71000	9900	20000
Phenanthrene	440	1500	90	23000	3100	6300
Anthracene	11000	37000	2200	540000	74000	150000
Fluoranthene	890	1600	290	23000	3100	6400
Pyrene	2000	3800	620	54000	7400	15000
Benz(a)anthracene	13	15	13	180	29	62
Chrysene	27	32	19	350	57	120
Benzo(b)fluoranthene	3.7	4.0	3.9	45	7.2	16.0
Benzo(k)fluoranthene	100	110	130	1200	190	440
Benzo(a)pyrene	3.0 5.0	3.2 5.3	3.5 5.7	36 77	5.7 10	13 21
Indeno(123cd)pyrene	41	46	39	510	82	180
Dibenzo(ah)anthracene	0.3	0.32	0.43	3.6	0.58	1.4
Benzo(ghi)perylene	350	360	640	4000	640	1600
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.0014	0.0015	0.0018	0.12	3.5	5.4
Trichloroethene (TCE)	0.075	0.08	0.21	5.7	120	120
1,1,1,2 Tetrachlorethane	6.4	8.2	4.4	560	1400	2100
Tetrachlorethane (PCE)	0.90	0.92	3.6	95	1400	1500
1,1,1 Trichlorethane	39	40	240	3000	140000	100000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs**
- Soil organic matter (SOM) is assumed to be 6% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 2.5% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 <u>21</u>	6 <u>21</u>	1.8 <u>170</u>	33 <u>49</u>	7.7 <u>21</u>	220 <u>250</u>
Lead	<u>200</u>	<u>310</u>	<u>80</u>	<u>2,300</u>	<u>630</u>	<u>1,300</u>
Mercury (elemental)	1	1	26	26	16	26 ⁽⁸⁾ [30]
Mercury (inorganic)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 <u>79</u>	170 <u>170</u>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₆	78	78	1700	5900	590000	130000
EC ₆ - EC ₈	230	230	5600	17000	610000	220000
EC ₈ - EC ₁₀	65	65	770	4800	13000	18000
EC ₁₀ - EC ₁₂	330	330	4400	23000	13000	23000
EC ₁₂ - EC ₁₆	2400	2400	13000	82000	13000	25000
EC ₁₆ - EC ₃₅	92000	92000	270000	1700000	250000	480000
EC ₃₅ - EC ₄₄	92000	92000	270000	1700000	250000	480000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₇	140	690	27	46000	56000	84000
EC ₇ - EC ₈	290	1800	51	110000	56000	95000
EC ₈ - EC ₁₀	83	110	21	8100	5000	8500
EC ₁₀ - EC ₁₂	180	590	31	28000	5000	9700
EC ₁₂ - EC ₁₆	330	2300	57	37000	5100	10000
EC ₁₆ - EC ₂₁	540	1900	110	28000	3800	7700
EC ₂₁ - EC ₃₅	1500	1900	820	28000	3800	7800
EC ₃₅ - EC ₄₄	1500	1900	820	28000	3800	7800
Aliph + Arom EC >44-70	1800	1900	2100	28000	3800	7800
<i>Aromatic</i>						
Benzene	0.16	0.49	0.035	50	72	100
Ethyl benzene	150	380	39	1200⁽⁸⁾ [35000]	1200⁽⁸⁾ [24000]	1200⁽⁸⁾ [22000]
Toluene	270	1300	51	1900⁽⁸⁾ [110000]	1900⁽⁸⁾ [56000]	1900⁽⁸⁾ [95000]
Xylene ⁽⁹⁾	98	120	70	1200⁽⁸⁾ [14000]	1200⁽⁸⁾ [42000]	1200⁽⁸⁾ [23000]
Phenol	290	420	140	1500⁽¹⁴⁾ (35000)	1500⁽¹⁴⁾ (10000)	1500⁽¹⁴⁾ (8300)
<i>Polycyclic Aromatic Hydrocarbons (PAH)</i>						
Naphthalene	5.6	5.6	10	460	4900	1900
Acenaphthylene	420	4600	69	97000	15000	30000
Acenaphthene	510	4700	85	97000	15000	30000
Fluorene	400	3800	67	68000	9900	20000
Phenanthrene	220	1500	38	22000	3100	6200
Anthracene	5400	35000	950	540000	74000	150000
Fluoranthene	560	1600	130	23000	3100	6300
Pyrene	1200	3800	270	54000	7400	15000
Benz(a)anthracene	11	14	6.5	170	29	56
Chrysene	22	31	9.4	350	57	110
Benzo(b)fluoranthene	3.3	4.0	2.1	44	7.2	15
Benzo(k)fluoranthene	93	110	75	1200	190	410
Benzo(a)pyrene	2.7	3.2	2	35	5.7	12
Indeno(123cd)pyrene	36	46	21	510	82	170
Dibenzo(ah)anthracene	0.28	0.32	0.27	3.6	0.57	1.3
Benzo(ghi)perylene	340	360	470	4000	640	1500
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00087	0.001	0.001	0.077	3.5	5
Trichloroethene (TCE)	0.034	0.036	0.091	2.6	120	91
1,1,1,2 Tetrachlorethane	2.8	3.5	1.9	250	1400	1800
Tetrachlorethane (PCE)	0.39	0.4	1.5	42	1400	1100
1,1,1 Trichlorethane	18	18	110	1300	140000	76000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs
- Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 1% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 21	6 21	1.8 170	33 49	7.7 21	220 250
Lead	200	310	80	2,300	630	1,300
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 79	170 170
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
Aliphatic risk banded hydrocarbons - TPHCWG method						
EC ₅₋₅ - EC ₆	42	42	730	3200	570000	95000
EC ₆₋₆ - EC ₈	100	100	2300	7800	600000	150000
EC ₈₋₈ - EC ₁₀	27	27	320	2000	13000	14000
EC ₁₀₋₁₀ - EC ₁₂	130	130	2200	9700	13000	21000
EC ₁₂₋₁₂ - EC ₁₆	1100	1100	11000	59000	13000	25000
EC ₁₆₋₁₆ - EC ₃₅	65000	65000	260000	1600000	250000	450000
EC ₃₅₋₃₅ - EC ₄₄	65000	65000	260000	1600000	250000	450000
Aromatic risk banded hydrocarbons - TPHCWG method						
EC ₅₋₅ - EC ₇	70	370	13	26000	56000	76000
EC ₇₋₇ - EC ₈	130	860	22	56000	56000	87000
EC ₈₋₈ - EC ₁₀	34	47	8.6	3500	5000	7200
EC ₁₀₋₁₀ - EC ₁₂	74	250	13	16000	5000	9200
EC ₁₂₋₁₂ - EC ₁₆	140	1800	23	36000	5100	10000
EC ₁₆₋₁₆ - EC ₂₁	260	1900	46	28000	3800	7600
EC ₂₁₋₂₁ - EC ₃₅	1100	1900	370	28000	3800	7800
EC ₃₅₋₃₅ - EC ₄₄	1100	1900	370	28000	3800	7800
Aliph + Arom EC >44-70	1600	1900	1200	28000	3800	7800
Aromatic						
Benzene	0.08	0.3	0.017	28	72	90
Ethyl benzene	65	170	16	520⁽⁸⁾ [17000]	520⁽⁸⁾ [24000]	520⁽⁸⁾ [17000]
Toluene	120	610	22	860⁽⁸⁾ [59000]	860⁽⁸⁾ [56000]	860⁽⁸⁾ [87000]
Xylene ⁽⁹⁾	41	53	28	480⁽⁸⁾ [69000]	480⁽⁸⁾ [41000]	480⁽⁸⁾ [17000]
Phenol	180	310	66	760⁽¹⁴⁾ (31000)	760⁽¹⁴⁾ (10000)	760⁽¹⁴⁾ (7600)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	2.3	2.3	4.1	190	4900	1200
Acenaphthylene	170	2900	28	83000	15000	29000
Acenaphthene	210	3000	34	84000	15000	29000
Fluorene	170	2800	27	63000	9900	20000
Phenanthrene	95	1300	15	22000	3100	6200
Anthracene	2400	31000	380	520000	74000	150000
Fluoranthene	280	1500	52	23000	3100	6300
Pyrene	620	3700	110	54000	7400	15000
Benz(a)anthracene	7.2	11	2.9	170	29	49
Chrysene	15	30	4.1	350	57	93
Benzo(b)fluoranthene	2.6	3.9	0.99	44	7.1	13
Benzo(k)fluoranthene	77	110	37	1200	190	370
Benzo(a)pyrene	2.2	3.2	0.97	35	5.7	11
Indeno(123cd)pyrene	27	45	9.5	500	82	150
Dibenzo(ah)anthracene	0.24	0.31	0.14	3.5	0.57	1.1
Benzo(ghi)perylene	320	360	290	3900	640	1400
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00064	0.00077	0.00055	0.059	3.5	4.8
Trichloroethene (TCE)	0.016	0.017	0.041	1.2	120	70
1,1,1,2 Tetrachlorethane	1.2	1.5	0.79	110	1400	1500
Tetrachlorethane (PCE)	0.18	0.18	0.65	19	1400	810
1,1,1 Trichlorethane	8.8	9	48	660	140000	57000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs**
- Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

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