



OUR REF: A4755/23/LR/3/V5
YOUR REF:

4th April 2024

Paul Sinclair
Westchurch Homes Ltd
31 Stamford Street
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WA14 1ES

By Email (paul.sinclair@westchurchhomes.co.uk)

Dear Paul,

Louisa Street, Openshaw
Soil & Groundwater Assessment Letter Report

Background and Terms of Reference

A GeoEnvironmental Site Investigation has been commissioned by Westchurch Homes Ltd (the Client) to further examine ground conditions particularly with reference the risk posed to controlled waters from soil.

Previous Reporting

This report should be read in conjunction with the following reports previously prepared by Earth Environmental & Geotechnical Ltd:

- Phase II GeoEnvironmental Site Investigation Report (Reference: A4755/22/SI, June 2022).
- Remediation Report (Reference: A4755/23/RMS/V5).

Reference

Earth Environmental and Geotechnical Ltd were commissioned to undertake an additional geo-environmental investigation of the site to retrieve further soil and groundwater samples for chemical analysis. The objectives of the investigation were as follows:

- To present the factual information on the work undertaken including sampling location plan, borehole logs and chemical testing.
- Tier 1 (semi-quantitative) risk assessment will be undertaken. This will compare the concentrations of soil leachate and groundwater contaminants identified against current and appropriate published guidelines, in relation to identified receptors, e.g., existing/ future end users and site neighbours.

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Proposed Development

It is understood that the client intends to construct two three-storey apartment blocks and twenty-nine dwellinghouses.

Figure 1 Proposed Development Layout Plan



Site Location and Site Elevations

The site is located in Openshaw, Manchester, approximately 4.6km from Manchester City Centre. The approximate National Grid Reference for the centre of the site is SJ 88592 97635 (X:388592, Y: 397635), with the closest postcode being M11 1AD.

The site is a near rectangular shaped parcel of land with current access via two gates off Louisa Street to the east of the site. The maximum dimensions of the proposed site are 82m north to south and 120m east to west. The site occupies an area of approximately 0.93 hectares.

The surrounding area comprises predominantly of residential properties. Industrial land uses are located immediately north of the site and to the south and southeast of the site. An open green space is located immediately south of the site along the boundary.

The site location is shown in the aerial photograph presented as Figure 1, below.

The site is generally flat lying at 79mAOD) with a fall from east to west (77mAOD).

Historical Development

The site was vacant land until it was occupied by an iron foundry (see Figure 2) from the early 1900's. The area was dominated by heavy industry including, iron and steel works, mills, stream hammer works, electric motor works and railway sheds and sidings.

Figure 2 Extract of 1908 Map



The majority of the buildings on site were demolished in 2017/2018.

Local Geology

Geological mapping indicates that the site is underlain by Boulder Clay and at depth the Triassic Chester Formation Sandstone (a Principal Aquifer).

The local area is shown as a glacial valley with deep superficial deposits extending to 20m.

Figure 3 overleaf shows a summary of ground conditions gained from online British Geological Survey boreholes.

Figure 3 Location of British Geological Survey Boreholes



The nearest deep borehole (SJ89NE123, 325m northwest) to the site reveals the depth of sandstone rockhead at 23.16m.

Borehole SJ89NE126 500m to the south east of the site encountered sandstone rockhead at 100m below ground level.

Previous exploratory holes generally encountered Made Ground to a maximum depth of 2.90m. Underlying the Made Ground in all exploratory boreholes were superficial deposits of variable clay and sand to a maximum proven depth of 15.00m bgl.

Borehole CP1 (location shown in Figure 3) proved the sequence shown in Table 1.

Table 1 Summary of Ground Conditions in EEG CP1

Soil Horizon	Top (m bgl)	Base (m bgl)	Thickness (m)
Made Ground	GL	1.1	1.1
Sand	1.1	2.3	1.2
Clay	2.3	2.8	0.5
Sand	2.8	11.5	8.7
Clay	11.5	15.+	3.5+
Sandstone	Not Encountered	Not Encountered	

Rockhead was not encountered.

Groundwater strikes were encountered during the fieldwork at depths between 3.50m and 4.00m bgl at two locations, with all other locations being dry.

Table 2: Summary of Ground Conditions Encountered

Location	Made Ground Thickness (m)	BASE SAND (m bgl)	BASE CLAY (m bgl)	Installation Response Zone	Water Strike	Water Depth 30/5/22	Water Depth 1/2/24
WS302	1.5	4.0+		1.0-4.0	DRY		DRY
WS303	2.50		4.0+	1.0-4.0	DRY		DRY
WS304	1.60	4.0+		1.0-4.0	DRY		DRY
WS305	3.40		4.7+	1.0-4.7	DRY		DRY
CP1	1.10	11.5	15.0+	No Well	DRY		
WS1	2.90		4.0+	1.0-4.0	2.50	2.69 (MG)	
WS2	2.50+			0.5-2.50		DRY	
WS3	1.50			1.0-5.0	4.0	3.58 (SAND)	
WS4	1.60			1.0-4.0	3.50	3.03 (SAND)	
WS5	2.50			1.0-5.0	DRY	DRY	
TP1	0.60	2.6+			DRY		
TP2	1.20	2.8+			DRY		
TP3	2.50		3.2+		DRY		
TP4	2.70		3.5+		DRY		
TP5	2.90		3.3+		DRY		
TP6	0.40+				DRY		
Minimum	0.60				2.50	2.69	
Average	2.03				3.33	3.10	
Maximum	3.40				4.0	3.58	

Table 2 highlights that groundwater was found at three locations WS1, WS3 and WS4 within a sand horizon and in made ground in the case of WS1. In all cases they are perched and not representative of a local water table.

Recently drilled wells (WS302 - WS305) were monitored on the 23rd January and 1st February 2024. All were found to be dry despite wells extending to 4.7m depth.

Hydrology and Hydrogeology

The British Geological Survey Clwyd and Cheshire Basin Hydrogeological map shows a groundwater elevation within the sandstone aquifer of 50mAOD and therefore approximately 29m below ground level.

There are 28 groundwater abstraction licence records within 2km of the site. The closest is an historical licence, issued in 1985 for a borehole on the "Air Products Chemicals Ltd" site at Clayton, 758m northwest.

There are 8 surface water abstraction licence records within 2km of the site.

The closest record is an historical licence 778m northwest of the site, for a point on the Ashton Canal for the abstraction of water for general cooling in 1969.

There are no potable water abstraction licence records within 2km of the site.

The site is not located within a Source Protection Zone or Source Protection Zone of a confined aquifer.

There are no water network entries within 250m of the site.

There are no water surface water features identified within 250m of the site.

The superficial deposits beneath the site are classified by the Environment Agency as a Secondary Undifferentiated Aquifer 'Assigned where it is not possible to attribute either a category A or B rock type.

The underlying Triassic Chester Pebble Beds Formation is classified by the Environment Agency (EA) as a Principal Aquifer. The sandstone has a high to moderate permeability and a mixed flow type. The BGS states the following: Principal Aquifer 'Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/ river base flow on a strategic scale.

There is 1 record of a Water Framework Directive (WDF) surface water body. This refers to the River Irwell, 4.8km west of the site, which had a failed chemical rating and a moderate ecological rating in 2019. 3.30

There is 1 record of a Water Framework Directive (WDF) groundwater body located on-site. The record refers to the Manchester and East Cheshire Permo-Triassic Sandstone Aquifers which had a poor chemical rating in 2019.

Landfill Sites

There are 3 records of an historical Environment Agency/Natural Resource Wales landfills within 500m of the site.

There is a record close to the western boundary which refers to an inert liquid sludge permit pertaining to the Manchester & Ashton Lyne Canal.

There are no records of the waste types or the date of deposition.

An Ordnance Survey plan of 1981 however shows the located of the infilled canal.

Figure 4 Landfill Site



Conceptual Model

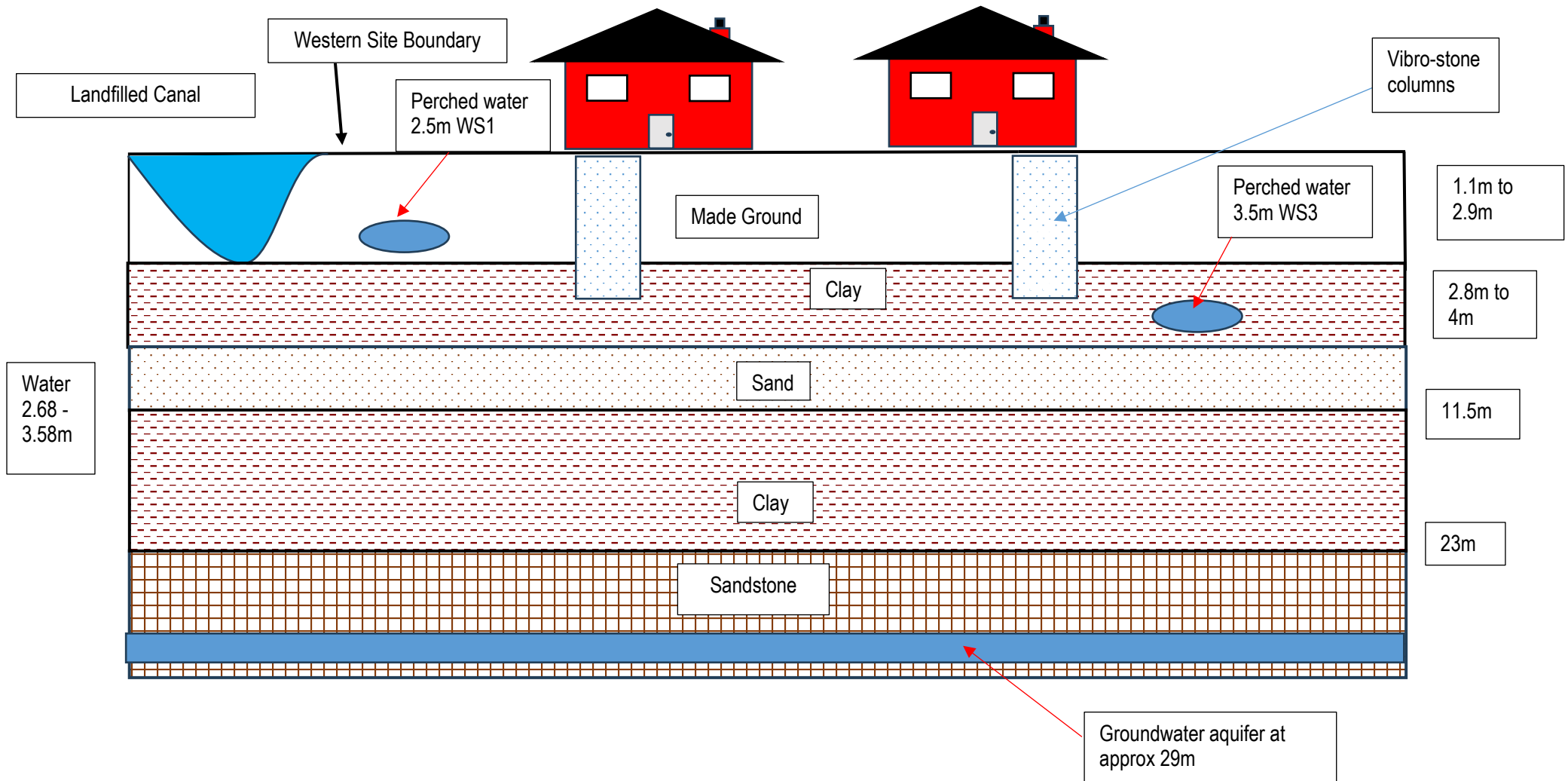
The environmental setting of the site has been summarised in Figure 5.

The salient points are;

- (i) An absence of controlled waters within 250m of the site;
- (ii) Sandstone rockhead greater than 15m beneath the site and locally at 23.6m;
- (iii) Superficial deposits consist of Boulder Clay with a complex sequence of sand and clay;
- (iv) Shallow groundwater table found in sand horizon;
- (v) No groundwater abstraction points within 2km of the site;
- (vi) Site is not located within a drinking water safeguarding zone;
- (vii) Landfill site adjacent to western site boundary;

Figure 5 shows the approximate depth of vibro-stone columns extending to a depth of 3m, which have been used to support shallow foundations and to densify surrounding soils.

Figure 5 Conceptual Model



Fieldwork

A secondary site investigation was conducted on the 16th January 2024 by Earth Environmental & Geotechnical Ltd. This comprised of the following:

- Four window sample boreholes (designated WS302 to WS305) were sunk to a maximum depth of 4.70m below ground level. Window sampler boring is carried out with a small, track-mounted rig, which uses a chain-driven trip hammer to drive sampling tubes or penetrometers into the ground. These tools are coupled to the anvil of the hammer by solid drill rods. Sampling tubes comprise “windowless samplers”, which are plain sampler tubes in which a continuous disturbed sample is recovered within a semi-rigid plastic liner. In order to reduce friction within the borehole, sampling tubes of progressively smaller diameter are used as the borehole depth increases. Sampler diameters generally range from between approximately 90mm to 50mm. Groundwater observations were noted where possible. These observations relate to the time of the investigation only, and do not necessarily reflect seasonal fluctuations. Exploratory hole logs are included in Appendix A.
- 50mm diameter standpipes were installed in both of the window sample boreholes to a maximum depth of 4.70m below ground level. Installation and backfill details are shown with the appropriate borehole log sheet.

An exploratory hole location plan for the additional and original sampling is provided as Figure 6, overleaf.

Figure 6: Location of EEG Boreholes



Chemical Testing

Leachate chemical analysis has been carried out on five leachate samples, from a depth range of ground level to 1m below ground level, and submitted for the following suite of determinants:

Arsenic, Barium, Beryllium, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc, Cyanide, Phenol, Sulphate (SO₄), Sulphide, pH, Total Organic Carbon (TOC), Speciated Polycyclic Aromatic Hydrocarbons (PAH) and Speciated Total Petroleum Hydrocarbons.

The GL to 1m depth range of sampling was adopted to also assess the potential effects of volatile compounds on human health risk. It should be noted that the made ground was consistent in composition. Therefore, testing from a deeper depth range is unlikely to reveal different leachability characteristics.

Two subsequent visits to conduct groundwater sampling were carried out on the 23rd January and 1st February 2024.

However, insufficient water was present, in all boreholes, to allow for groundwater sampling.

In the absence of specific UK guidelines regarding groundwater quality in the UK, soil leachate chemical results obtained by EEG have been compared with the following statutory and non-statutory standards:

- Environmental Quality Standards (EQS); and
- UK Drinking Water standards ⁽²⁰⁰⁰⁾.

Many of the EQS values lie just above the method detection limit for parameters and as such, are extremely conservative.

In the absence of EQS values, Drinking Water Standards have been used for comparison of results. Again, these standards are highly conservative, especially in this site context.

A direct comparison was made between the leachate analyses results and the EQS and Drinking Water Standards, and the results are summarised in Table 3, below.

The results of the groundwater sampling from the original site investigation are also included in the report as Table 4, overleaf.

Table 3: Leachate Results Comparison with EQS/Drinking Water Quality Values

Determinand	EQS Value (1)	Drinking Water Quality (DWQ) Value (2)	WS302 0.20m	WS303 0.50m	WS304 0.20m	WS304 0.70m	WS305 0.30m	No. of Exceedances
Arsenic	50	10	0.4	0.8	1	3.6	2.6	0
Cadmium	0.9	5	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0
Chromium	50	-	0.3	< 0.2	< 0.2	1.6	0.4	0
Lead	1.2-14	10	< 0.2	0.2	0.3	< 0.2	0.4	0
Mercury	0.07	1.0	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	0
Selenium	-	10	< 0.2	< 0.2	< 0.2	0.2	0.4	0
Nickel	50-200	20	0.5	0.4	0.4	1.1	1	0
Zinc	75	-	< 1	< 1	< 1	< 1	< 1	0
Cyanide	-	50	< 5	< 5	< 5	< 5	< 5	0
Phenol	7.7-46	-	< 10	< 10	< 10	< 10	< 10	0
Sulphate	250000	250000	30	14	15	42	33	0
pH	6 – 9	-	7.8	8	7.9	10.2	8.8	1 for (1)
Naphthalene	10	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0
Anthracene	0.1	-	< 0.01	< 0.01	< 0.01	0.03	< 0.01	0
Benzo(a)pyrene	0.27	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0
Benzo(b)fluoranthene	0.017	0.10	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0
Benzo(k)fluoranthene	0.017	-	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0
Indeno(123cd)pyrene	-	0.10	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0
Fluoranthene	0.12	-	< 0.01	0.02	< 0.01	0.05	0.04	0
Aliphatic >C5-C6	15000	-	< 10	< 10	< 10	< 10	< 10	0
Aliphatic >C6-C8	15000	-	< 10	< 10	< 10	< 10	< 10	0
Aliphatic >C8-C10	300	-	< 10	< 10	< 10	< 10	< 10	0
Aliphatic >C10-C12	300	-	< 10	< 10	< 10	< 10	< 10	0
Aliphatic >C12-C16	300	-	< 10	< 10	< 10	< 10	11	0
Aromatic >C5-C7	10	1	< 10	< 10	< 10	< 10	< 10	0
Aromatic >C7-C8	700	-	< 10	< 10	< 10	< 10	< 10	0
Aromatic >C8-C10	300	-	< 10	< 10	< 10	< 10	< 10	0
Aromatic >C10-C12	90	-	< 10	< 10	< 10	< 10	< 10	0
Aromatic >C12-C16	90	-	< 10	< 10	< 10	< 10	< 10	0
Aromatic >C16-C21	90	-	< 10	< 10	< 10	< 10	24	0
Aromatic >C21-C35	90	-	< 10	< 10	< 10	< 10	< 10	0
Benzene	10-50	1	< 1	< 1	< 1	< 1	< 1	0
Toluene	50-380	-	< 5	< 5	< 5	< 5	< 5	0
Ethylbenzene	20-200	-	< 5	< 5	< 5	< 5	< 5	0
Xylenes	30	0.10	< 5	< 5	< 5	< 5	< 5	0

Notes for Table 3

All units in ug/l.

Concentrations in **red** above assessment criteria.

Table 4: Groundwater Results Comparison with EQS/Drinking Water Quality Values

Determinand	EQS Value (1)	Drinking Water Quality (DWQ) Value (2)	WS1	WS4	No. of Exceedances
Arsenic	50	10	< 5	< 5	0
Cadmium	0.9	5	< 0.4	< 0.4	0
Chromium	50	-	< 5	< 5	0
Copper	10	2000	< 5	< 5	0
Lead	1.2 - 14	10	< 5	< 5	0
Mercury	0.07	1.0	< 0.05	< 0.05	0
Selenium	-	10	< 5	< 5	0
Nickel	50 - 200	20	7	< 5	0
Zinc	75	-	8	< 2	0
Cyanide	-	50	< 5	< 5	0
Phenol	7.7 - 46	-	< 10	< 10	0
Sulphate	400000	250000	112	24	0
pH	6 - 9	-	7.0	6.8	0
Naphthalene	10	-	0.03	0.02	0
Anthracene	0.1	-	< 0.01	< 0.01	0
Benzo(a)pyrene	0.27	0.01	< 0.01	< 0.01	0
Benzo(b)fluoranthene	0.017	0.10	< 0.01	< 0.01	0
Benzo(k)fluoranthene	0.017	-	< 0.01	< 0.01	0
Indeno(123cd) pyrene	-	0.10	< 0.01	< 0.01	0
Fluoranthene	0.12	-	0.03	0.02	0
Benzene	10 - 50	1	< 1	< 1	0
Toluene	50 - 380	-	< 5	< 5	0
Ethylbenzene	20 - 200	300 (WHO)	< 5	< 5	0
Xylenes	30	-	< 25	< 25	0
Total Petroleum Hydrocarbons Aro C6-C8	-	10	< 10	< 10	0
Total Petroleum Hydrocarbons Aro C8-C10	-	700	< 10	< 10	0
Total Petroleum Hydrocarbons Aro C10-C12	-	300	< 10	< 10	0
Total Petroleum Hydrocarbons Aro C12-C16	-	90	< 10	< 10	0
Total Petroleum Hydrocarbons Aro C16-C21	-	90	< 10	< 10	0
Total Petroleum Hydrocarbons Aro C21-C35	-	90	< 10	< 10	0
Total Petroleum Hydrocarbons Ali C6-C8	-	15000	< 10	< 10	0
Total Petroleum Hydrocarbons Ali C8-C10	-	15000	< 10	< 10	0
Total Petroleum Hydrocarbons Ali C10-C12	-	300	< 10	< 10	0
Total Petroleum Hydrocarbons Ali C12-C16	-	300	< 10	< 10	0

Notes for Table 4

All units in ug/l.

Concentrations in **red** above assessment criteria.

Based on the above tables, only one exceedance was identified. This is for an elevated pH value from the additional leachate testing at WS304 (0.70m).

This elevated pH value is thought to have been caused by the presence of concrete in the soil sample prior to leachate sample preparation. This is therefore considered not to be a risk to groundwater quality.

Given the environmental setting of the site, and lack of significant exceedances, the risk to groundwater from contamination is considered low.

Conclusions & Recommendations

EEG have attempted to undertake groundwater monitoring visits in 2022, 2023 & 2024. Only three of the nine installed monitoring wells have provided sufficient water, on a singular visit, to allow for any meaningful groundwater sampling.

No significant elevated chemical contaminants of concern have been identified in the samples tested during the additional soil leachate or original groundwater analysis.

Therefore, based on the ground conditions and environmental testing, there is considered to be no potential impact to controlled waters beneath the site and the site is suitable for use with no remedial measures necessary.

Site won soils are considered to be uncontaminated with respect to human health and controlled waters and therefore can be used within the framework of a CL:AIRE Waste Code of Practice (DoWCoP) Material Management Plan.

Should you have any queries regarding the contents of this report, please feel free to contact me at any time.

Yours Sincerely,

Adam Czarnecki

**Adam Czarnecki BSc(Hons) FGS CGeol
Director
For and on behalf of Earth Environmental & Geotechnical Ltd**

Appendix A Borehole Logs
Appendix B Soil Leaching Test Results

APPENDIX A

EXPLORATORY HOLE LOGS

APPENDIX B

SOIL LEACHATE TESTING RESULTS