

Contract No:	C4851
Project:	New Victoria, Manchester
Date:	16/09/20

Foundation Design - Groundwater Considerations

Foundation Works Risk Assessment

CFA piling methods are to be used for this project. Displacement methods are deemed unsuitable due to the presence of sandstone, which will prevent pile installation for driven and auger displacement techniques. Rotary bored piling methods are considered less economic for the site ground conditions and will result in a higher risk rating.

The risks of pollution to groundwater associated with pile construction by these methods have been assessed in accordance with the Environment Agency's National Groundwater and Contaminated Land Centre report, NC/99/73: "Piling and penetrative ground improvement methods on land affected by contamination: Guidance on pollution prevention".

Risk Assessment

The Environment Agency guidance considers six possible pollution scenarios which are described in detail below. The degree of risk associated with each scenario has been assessed by multiplying the likelihood (on a scale of 1 to 3) by the effect (on a scale of 1 to 3). These ratings are as follows:

- Likelihood - unlikely (1), likely (2), probable (3)
- Effect - none (1), insignificant (2), significant (3)
- The maximum risk rating for each scenario is 9 (3x3)
- The maximum overall risk rating for the project considering all six scenarios is 54 (6x9).

Basis of Assessment

This assessment is based upon the findings and recommendations of the following documents:

- Vertase FLI, 2018, Site Investigation Report (reference 1730MUS)
 - States the site is not located within a groundwater source protection zone.
 - Records asbestos contamination at a number of locations and depths up to 3.0m.
- Allied Exploration Geotechnics, 2017, Retaining Wall Structural Investigation (reference NW1564)
 - Records no occurrences of contamination
- Allied Exploration Geotechnics, 2016, Ground Investigation Factual Report (reference PR1531)
 - Chemical and hydrocarbon odours noted at a number of locations and depths up to 5m.
- Bridgeway Consulting Limited, 2012, Ground Investigation Report
 - Records visible evidence of hydrocarbon contamination at numerous locations and depths up to 3.5m
- Ove Arup & Partners, 2018, Earthworks and Remediation Performance Specification, reference VIC-ARUP-ZZ-XX-SP-CG-0001 P1

None of the above reports refer to any surface or ground water abstractions within close proximity to the site, and it is assumed that none exist within a radius of 250m.

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The River Irk passes through a culvert directly underlying the site. The culvert is assumed to be in good condition breaking any potential pollutant linkages.

It is assumed that any contamination encountered on site has been remediated in accordance with the Ove Arup & Partners specification.

Scenario 1 Creation of preferential pathways, through low permeability layer (an aquitard) to allow potential contamination of an underlying aquifer.	
<u>Likelihood</u> The method relies on removal of a cylinder of soil into which the pile is constructed. Once the desired depth is obtained the auger is removed and concrete is injected into the void created. The high slump concrete forms a close contact with the soils and fills any localised voids immediately adjacent to the pile. This scenario is considered unlikely.	1
<u>Effect</u> No known surface water abstractions, ground water abstractions or groundwater source protection zones are in close vicinity to the site. The River Irk culvert passing through the site is to be inspected in advance and construction works are to be planned to prevent any damage to the culvert.	1
Risk Rating (out of 9)	1

Scenario 2 Creation of preferential pathways, through a low permeability surface layer, to allow upward migration of landfill gas, soil gas or contaminant vapours to the surface.	
<u>Likelihood</u> The short term “void” created during pile construction is partially protected by the loosened pile spoil and plugged when the concrete is injected. Flighting of the soils is to be controlled to prevent any further loosening.	1
<u>Effect</u> Any contaminants within superficial soils, including known contaminants at shallow depths, are to be remediated by the Main Contractor in accordance with the Earthworks and Remediation Performance Specification.	1
Risk Rating (out of 9)	1

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Scenario 3 Direct contact of site workers and others with contaminated soil arisings, which have been brought to the surface.	
Likelihood During pile construction arisings of soil will be brought to the surface. Arising will be cleared from the auger at surface level for reasons of health and safety. Arisings will generally be handled mechanically by excavator and dumper but operatives may come into contact with them when accessing the pile for inspection or to place reinforcement. It is assumed that surface contamination will be removed and/or remediated by other trades prior to the commencement of piling.	2
Effect It is assumed that all high risk contaminants, including asbestos, will be removed and/or remediated by other trades prior to the commencement of piling. Additional controls to include good hygiene procedures and use of PPE (gloves, full length clothing, eye protection etc).	1
Risk Rating (out of 9)	2

Scenario 4 Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where secondary effects are to increase the potential for contaminant migration).	
Likelihood The constructed piles will be in direct contact with made ground and any potential leachate. The piles are to be constructed using concrete to a ground aggressivity specification determined by the GIR and/or pile design. This will minimise the risk of pile degradation.	1
Effect Risk associated with preferential pathways (see scenarios 1 & 2) is low.	1
Risk Rating (out of 9)	1

Scenario 5 The driving of solid contaminants down into an aquifer during pile driving.	
Likelihood The CFA method cuts into the soil so that material remains at constant elevation or is lifted during pile construction. This scenario is therefore considered unlikely.	1
Effect Any contaminants within superficial soils, including known contaminants at shallow depths, are assumed to have been remediated in accordance with the Earthworks and Remediation Performance Specification.	1
Risk Rating (out of 9)	1

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Scenario 6	
Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout.	
Likelihood The method requires the injection of concrete under pressure, which may result in concrete flowing beyond the area of the pile where voids are present. A quick setting concrete mix will be used (relative to a flowing grout). The loss of large volumes of concrete will be prevented by use of CFA monitoring equipment.	2
Effect Surface water is expected to be managed by the provision of free draining piling platforms. No ground water abstractions or source protection zones are known to exist close to the site.	1
Risk Rating (out of 9)	2
Total	
Risk rating (out of 54)	8

Commentary

Only scenarios 3 and 6 result in a risk rating exceeding 1.

The risk rating resulting from scenario 3 may be significantly reduced by a managed decontamination process, and by additional control measures during construction.

The risk rating resulting from scenario 6 may be significantly reduced by use of CFA monitoring equipment, together with additional control measures during construction.

Further control measures are to be implemented during construction to ensure that the likelihood of each scenario either does not exceed, or is reduced, from those recorded above.

Risk to groundwater is therefore considered to be acceptable for the stated piling methodology.