

Project:	Trinity Islands, Manchester
Date:	16/08/22

Foundation Design - Groundwater Considerations

CFA piling methods are to be used for this project. These techniques are selected over displacement methods are deemed unsuitable due to the presence of sandstone, which will prevent pile installation for driven and bored 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".

Reference Documents

WSP Phase 1 Preliminary Risk Assessment, reference 70082598-11789 (issue 3)
WSP Phase 2 Ground Investigation Report, reference 70082598-11833 (issue 4)

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).

<u>Scenario 1</u> 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> Risk ranking is assessed as low due to the absence of surface water abstractions, ground water abstractions and source protection zones close to the site (not within 500m, reference WSP PRA).	1
Risk Rating (out of 9)	1
<u>Scenario 2</u> 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>	1

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The short term void created during pile construction is partially protected by the loosened pile spoil and plugged when the concrete is inject. Flighting of the soils is to be controlled to prevent any further loosening.	
<u>Effect</u> No contaminants exceeding test thresholds have been encountered within the soils beneath the overlying made ground and upper sand strata (reference WSP GIR).	1
Risk Rating (out of 9)	1
<u>Scenario 3</u> Direct contact of site workers and others with contaminated soil arisings, which have been brought to the surface.	
<u>Likelihood</u> 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
<u>Effect</u> Risk to construction workers is considered moderate due to the short exposure duration (reference WSP PRA), and is to be reduced by the adoption of good hygiene procedures and PPE. It is assumed that high risk contaminants, including asbestos, will be removed and/or remediated by other trades prior to the commencement of piling.	2
Risk Rating (out of 9)	4
<u>Scenario 4</u> 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).	
<u>Likelihood</u> The constructed piles will be in direct contact with made ground and any potential leachate. The pile may be constructed using concrete to a ground aggressivity specification determined by the GIR. This will minimise the risk of pile degradation.	1
<u>Effect</u> Risk associated with preferential pathways (see scenarios 1 & 2) is low.	1
Risk Rating (out of 9)	1
<u>Scenario 5</u> The driving of solid contaminants down into an aquifer during pile driving.	
<u>Likelihood</u> 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
<u>Effect</u> Since contaminants have been observed in upper soils, and the lower soils are considered a primary aquifer, the effect of this scenario under a different methodology would be considered significant. However for the selected construction technique the scenario is unlikely to be realised.	2
Risk Rating (out of 9)	2
<u>Scenario 6</u> Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout.	
<u>Likelihood</u>	2

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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. It is likely that the piling contractor will specify a quick setting concrete mix rather than a flowing grout. It is also uneconomic to allow the loss of large volumes of concrete. Therefore well controlled construction processes will minimise the likelihood of this scenario.	
<u>Effect</u> Surface water is expected to be managed by the provision of free draining piling platforms. No ground water abstractions or source protection zones exist close to the site (reference Cundall GEA). The effect is therefore insignificant.	1
Risk Rating (out of 9)	2
<u>Total</u>	
Risk rating (out of 54)	11

Commentary

Only scenarios 3 and 5 result in a risk rating exceeding 1.

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

The likelihood of scenario 5 is considered negligible. While the effect of the scenario is significant, the associated risk rating is considered accentuated by the risk rating methodology. The overall increase in risk to groundwater is negligible.

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.