Remediation of a Former Chemical Factory - Four Ashes, Staffordshire

FLI QDS Remediation, together with Hydrock Consultants are delighted with their recent Brownfield Briefing Award for Best Use of a Combination of Remediation Techniques.

The former Four Ashes chemical factory was redeveloped by Bericote Properties. The first phase was a 545,000 ft² manufacturing facility. The close working partnership with Hydrock and the Principal Contractor, Readie Construction, enabled QDS to design and implement an innovative, sustainable and cost-effective Remediation Strategy for the redevelopment.

Comprehensive post-demolition investigations completed at the 32 hectare site had identified both soil and groundwater contamination associated with the site's operational past. Over 40,000m³ of heavily impacted soils were identified as requiring remediation, the primary contaminants of which were phenol, petroleum hydrocarbons, BTEX and chlorinated solvents. In addition, large volumes of fibrous asbestos were found in the underlying Made Ground.

Figure 1: Four Ashes site in development

Innovative, sustainable and cost-effective Remediation Strategy

Working in conjunction with Hydrock Consultants, QDS agreed a robust remediation strategy with the Environment Agency and the local authority which would render the site suitable for its redevelopment.

Through further investigation and chemical sampling, a better understanding of the chemical contaminants and their distribution was established at an early stage of the project.

3-D modelling and further Detailed Quantitative Risk Assessment indicated that remediation of contamination in the Made Ground and the underlying Glacial Deposits was sufficient to protect the Sherwood Sandstone Principal Aquifer.

Excavation and ex situ bioremediation

25,000m³ of impacted soils from the contamination hotspots were excavated to the top of the underlying water table. The soils were transported to a dedicated soil treatment area where they were screened, processed, and then engineered into two kilometres of windrows. Breathable, water repellent covers were utilised to reduce moisture content and stimulate aerobic bioremediation. Mechanical turning of the windrows was completed when seasonal temperatures increased.

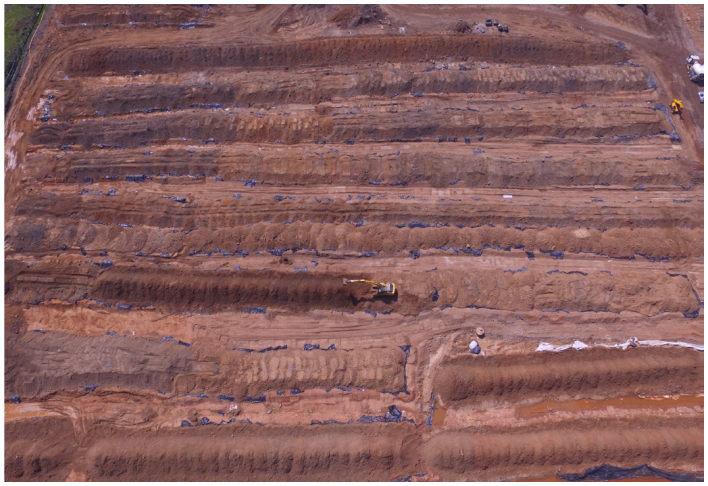

Figure 2: Soil treatment area with two kilometres of windrows

Following six months of active bioremediation, 100% of the soils had achieved the required remedial targets. All treated soils were reused by the developer in accordance with the site's Materials Management Plan.

In situ chemical oxidation with soil stabilisation

Laboratory trials identified that the high silt content of the remaining 15,000m³ of deeper impacted saturated soils reduced permeability, thereby preventing distribution of reagents via traditional injection methods.

A total of 1,200,000 litres of liquid reagent was applied to the treatment area using in situ mixing. After an extensive validation phase, 90% reductions in both soil and groundwater contaminant concentrations

were consistently achieved, meeting the stringent remediation criteria.

Soil stabilisation was utilised as a final phase of treatment in order to meet a 5% CBR geotechnical criteria over the chemical oxidation area.

Asbestos management

Widespread asbestos pipe lagging was identified within the Made Ground during the remediation works. QDS identified that there was the potential to retain the asbestos impacted soils on site by placing them at depth under areas of planned landscaping, thereby providing significant cost savings and contributing to the overall sustainability of the site.

A total of 2,000m³ of impacted Made Ground was placed under the landscaped areas and a further 1,200kg of bulk asbestos containing materials were removed from site. All works were completed in accordance with the Remediation Strategy and Materials Management Plan by a licensed asbestos subcontractor.

Water management

A high water table and widespread groundwater contamination posed a major difficulty for the groundworks phase. QDS recognised that a comprehensive water management system was required in the early stages of the project's life.

Through active engagement with all stakeholders, infrastructure comprised of lagoons, drainage channels and three kilometres of pipework was used to abstract and pump water to a bespoke automated water treatment plant operated and maintained by QDS. 44,000m³ of water was successfully treated and discharged into the neighbouring canal under consent from The Canal Trust.

Cost effective, durable remediation

Through work with Hydrock in defining risk and focus on key contaminant source areas QDS were able to deliver the works at a fixed price to the client. The design enabled remediation to be completed concurrently with the construction phase, providing major cost and programme savings.

The remedial works have permanently removed a major environmental liability which had the potential to seriously impact a valuable groundwater resource.

Significant reduction (rather than transfer) of the pollution burden

The design was based entirely around reduction of the pollution burden. Mass balance calculations

Figure 3: Seven metre deep press pit construction in manufacturing facility required the use of FLI QDS' water management expertise

demonstrated the destruction of more than 115,000kg of hydrocarbons in soil and groundwater. Multiple technologies were applied to achieve the greatest benefit, with bioremediation of less impacted soils combined with chemical oxidation of the highly impacted saturated source zone. Sustainability was also key with 99.9% of material re-used on site and only untreatables, such as asbestos, buried drums and hydrocarbon sludges disposed off-site.

If you would like further details on the project, we can provide our case study for the site.

Please contact our Operations Director, Jamie Harris on **01483 303070** *or email* **jharris@fli-qds.co.uk**