



The site investigative work carried out by GIP identified total petroleum hydrocarbon [TPH] contamination in both soils and groundwater included the presence of free product. TPH contamination within soils was considered to be significant – the maximum identified concentration was 104,000mg/kg confirming the likely presence of free product. Borehole sampling and analysis confirmed that the underlying groundwater was also significantly impacted – the maximum identified concentration exceeded 3,400mg/l. There were clear identified risks to both potential human health and groundwater receptors – the prime groundwater receptor being the nearby Hatchford Brook.

Site Background & History

The site is located on the south side of the Coventry Road in the Sheldon area of Birmingham. The site occupies 2 hectares and is being redeveloped for retail purposes including a Morrison's supermarket – see Figure 1. The site had recently been cleared and previously comprised of two large office blocks with associated car parks and hardstanding. Prior to the construction of the office blocks the site formed part of an engineering and locomotive maintenance works (circa 1950's) and was subsequently utilised as a plant hire depot.

Figure 1 – Proposed Development



The site investigative work was undertaken by GIP acting on behalf of Chase Midland Estates Limited. GIP identified the presence of hydrocarbon contamination in the area of the site associated with the former engineering and locomotive maintenance works / plant hire depot. The nature of the contamination was consistent with historical activities on site.

A number of remediation options were considered and precluded on the basis of cost and / or inability to achieve site remediation within the required timeframes. Working closely with Chase Midland Estates Limited [Chase], GIP, Birmingham City Council and the Environment Agency [EA], a commercially viable remediation strategy was developed which addressed identified human health and environmental concerns and also enabled the site to be developed by discharge of planning conditions relating to site contamination issues.

Remediation Objectives

Envirotreast were commissioned by Chase to undertake the following:

1. Formulation and approval of a remediation strategy to satisfy EA and planning requirements
2. Validation of all excavations (as required by WSP to confirm the identification and removal / treatment of all contamination within the designated area)
3. Management and implementation of the agreed remediation strategy for the excavation and treatment of contaminated soils and associated groundwater

4. Management (and implementation) of the reuse of treated and validated soils on site – soils to be reused as a substitute for imported fill
5. Preparation and submission of a comprehensive validation report to satisfy the requirements of the Council and the EA

Methodology

The proposed remediation strategy comprised of E-Clay stabilisation of the main source contamination with the simultaneous installation of an E-Clay Permeable Reactive Barrier to treat residual groundwater contamination. The barrier was designed to intercept and treat potentially contaminated groundwater migrating from the south east corner of the site (in the direction of the Hatchford Brook).

Envirotreat produced a Method Statement outlining the site history, contamination issues, proposed remediation strategy & technical rationale, environmental protection measures required during the remediation works and validation protocols for the treatment element of the works. The original proposal was to treat the contamination and install the reactive barrier by *in-situ* methodologies – it was subsequently decided to utilise *ex-situ* methodologies as all soil materials needed to be excavated / removed to expose the sides and bases of the excavations for validation purposes (and henceforth *ex-situ* treatment was considered to be the most practical approach).

The first phase of the works comprised of the barrier installation. This involved the excavation of sectional lengths along the proposed barrier alignment to the depth of the weathered mudstone. The excavated soils were mixed *ex-situ* with the designated reactive barrier E-Clay slurry formulation and re-emplaced in sectional lengths.

Validation samples were taken along the full barrier length to demonstrate that the contamination had been fully identified and removed in the barrier alignment.

The barrier installation is shown in Figure 2.

Figure 2 – Barrier Installation



The next phase of the remediation works comprised of the excavation of contaminated soils and lateral / vertical validation of the excavations – this was carried out initially by visual / olfactory observation and subsequently by laboratory verification. A 25m² grid reference system was utilised for validation purposes. The agreed target threshold was 1,000mg/kg TPH. The validation process identified the presence of contamination extending beyond the original area identified in the remediation strategy. The contaminated soils (and associated groundwaters) which exceeded the target threshold were excavated for subsequent treatment. The identified contaminated soils are illustrated in Figure 3.

Figure 3 – Identified Contaminated Soils



Excavated soils were treated with a designated advanced stabilisation media comprising of E-Clay slurry and cementitious additives. The treatment process is shown in Figure 4.

Figure 4 – Treatment of Contaminated Soils



Treated soils were validated in accordance with the agreed remediation strategy and leachate results were compared to the remediation target criterion (1,000ug/l TPH).

On successful validation the treated materials were reused on site to backfill the excavations. It was essential that the remediated area had the requisite bearing capacity for the intended end use of the site in this area - the treated soils were therefore placed in 150mm layers and compacted. Approximately 900m³ of contaminated soils were excavated, treated and re-used on site.

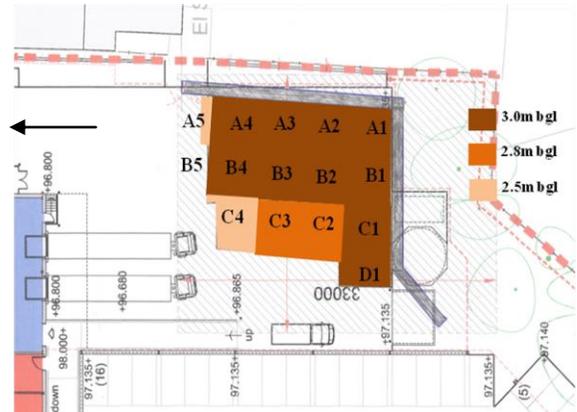
Significant volumes of contaminated groundwater were encountered during the remediation works. The contaminated groundwater was pumped from the excavations and incorporated within the treatment process - it was estimated that 20,000 litres of contaminated water was utilised and treated in the process.

Following completion of the stabilisation works the barrier was extended to fully encompass the treatment area. The total barrier length was 45.5m - the barrier was installed to a depth of circa 3mbgl directly overlying the relatively impermeable weathered mudstone layer.

The remediation works were undertaken within a four week timescale.

The implemented remediation strategy is shown diagrammatically in Figure 5.

Figure 5 – Implemented Remediation Strategy



The treated [stabilised] soil area is shown in brown colouration; the reactive barrier is shown in grey colouration. The 25m² grid reference system is also shown (A1 – D1 inclusive).

Validation

The works were undertaken in accordance with the approved Method Statement. It was agreed that the suitability of treated material for reuse on site would be determined by compliance with designated leachate target values. The treated materials were seen as a necessary part of the works and negated any requirement to utilise imported fill (to return the site to pre-remediation formation levels).

Following a suitable period of “curing” representative samples of treated soils were leach tested and compared with the derived leachate target criteria for TPH. A total of 10 samples were tested and all leachate values were compliant with the remediation criteria (TPH <1,000µg/l). The treated material was therefore considered suitable for reuse on site and subsequently re-emplaced in the void spaces created by the validated excavations as a substitute for imported fill.

Following completion of the remediation works the site was levelled as shown in Figure 6.

Figure 6 – Site Post Remediation



Conclusions

Enviro-treat were able to demonstrate through a comprehensive validation report that the overall remediation strategy had been successfully implemented.

The prime drivers for the remediation works were the protection of human health and controlled waters.

The Validation Report was approved by Birmingham City Council and the Environment Agency.

The relevant planning conditions relating to contamination issues were discharged enabling the development to proceed.