CASE STUDY

Ex-Situ Bioremediation

Former Industrial Site, Hampshire

Client

Reconomy

The site was located in Bishop's Waltham in Hampshire and was irregular in shape covering an area of approximately 4 hectares in total, bisected by a public highway. The northern area of the site was mostly occupied by a pond. The southern area of the site consisted of undergrowth to the east and a former industrial area to the west - the proposed main development of the site was on this area of the site.

The site is shown in Figure 1 below.

Figure 1 – Abbey Mills Site

The location of the industrial area is shown in Figure 2 below. Significant hydrocarbon contamination was identified on this area of site consistent with its previous industrial usage as a haulage and transport centre which included mechanic's garages and various industrial units.

Detailed speciation of the hydrocarbons indicated the presence of a mixture of weathered petrol and diesel species. Several underground fuel storage tanks were known to have been present which are assumed to be the prime contamination sources.

Figure 2 - Industrial Area

Groundwater was encountered within the near surface alluvium at depths of between 1.4m and 3.0m Analytical results of the groundwater indicated contamination levels of fuel related hydrocarbons exceeding UK drinking water standards by several orders of magnitude.

Several receptors were identified comprising of major and minor aquifers, a river and site workers / end users.

Envirotreat concluded that it would be necessary to address both the contaminated soils and groundwater on the site. This would provide the necessary protection of both human health and the shallow groundwater and surface water located within the area.

A planning application had been submitted [2010] for the erection of a retail store and doctor's surgery with undercroft car parking, refurbishment of an existing mill building for residential flats and ancillary store uses. In addition, the planning application included associated landscaping and road access improvements to the site.

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Objectives

The project consultants, Geotechnical and Environmental Associates [GEA], proposed localised excavation and on-site bioremediation of the identified contaminated soils on the site, primarily located in the central and south-western parts of the site.

It was also proposed that the hydrocarbon contamination in the near-surface groundwater should be remediated through a 'pump and treat' system or alternatively through dual phase vacuum extraction.

Envirotreat were commissioned by the main contractor, Wastefile [now Reconomy], to undertake bioremediation and groundwater remediation. Target levels for bioremediation were determined by GEA as summarised in Table 1 below.

Table 1 - GEA Target Criteria

Contaminant	Guideline Value (mg/kg)	Source
Benzene	0.056	SGV
Toluene	7	SGV
Ethyl Benzene	21	SGV
Xylene	15	SGV
Aliphatic C5-C6	18	GGV
Aliphatic C7-C8	57	GGV
Aliphatic C9-C10	3.5	GGV
Aliphatic C11-C12	20	GGV
Aliphatic C13-C16	107	GGV
Aliphatic C17-C36	61,400	GGV
Aromatic C6-C7	See benzene	SGV
Aromatic C7-C8	See toluene	SGV
Aromatic C9-C10	2.73	GGV
Aromatic C11-C12	4.83	GGV
Aromatic C13-C16	5.54	GGV
Aromatic C17-C21	132	GGV
Aromatic C22-C35	161	GGV
Lube Oil (C28-C40)	61,561	GGV
Total PAH	41	

Methodology

Identified contaminated soils were excavated and stockpiled for remediation. The sides and bases of the excavations were screened on-site by PID and analysed for speciated petroleum hydrocarbon concentrations by an off-site accredited laboratory.

The proposed remediation strategy involved the *ex-situ* bioremediation of hydrocarbon impacted soils using controlled biopiles of approximately 2,500m^3 in size. The biopiles were constructed to provide optimum performance incorporating specific soil conditioners. The designated amendments were based on treatability trials and evaluation of the analytical data presented within the site investigation report.

Key parameters were monitored throughout the remediation programme and the operating conditions were amended accordingly. These parameters included temperature, gas levels, organism numbers, pH and nutrient levels. The biopile was covered with a breathable membrane to optimise the treatment process.

The treatment operation was designed to reduce the concentrations of the identified contaminants through their degradation by micro-organisms.

The remediation strategy also required the removal and off-site disposal of free-phase hydrocarbon contamination. Skimmer pumps were employed to remove water and free-phase contamination from an excavated trench - the recovered free phase was subsequently removed from site. The contaminated groundwater was stored and treated on-site using a bespoke water treatment unit. Compliant treated groundwater was discharged into the local sewer.

Composite samples were obtained for validation purposes (one sample per 50m^3 treated). Analysis of total soil concentrations was carried out by an external laboratory. Groundwater quality was monitored at downstream monitoring wells.

Following successful treatment of the contaminated material, the soil was reused on site as specified in the remediation strategy. The results demonstrated compliance with the end-use target criteria for the site as a whole.

The proposed development is shown in Figure 3 below.

Figure 3 - Proposed Development