

Appendix 2

Case Study 1: Washwood Heath (WWH)

The WWH site is located at the Birmingham Spur and covers an area of approximately 68 hectares. The construction comprises of a retained cut which links the western portal of the Bromford Tunnel back to ground level. The D-walls make up the majority of the retained cut with secant piles and sheet piles making up the latter length.

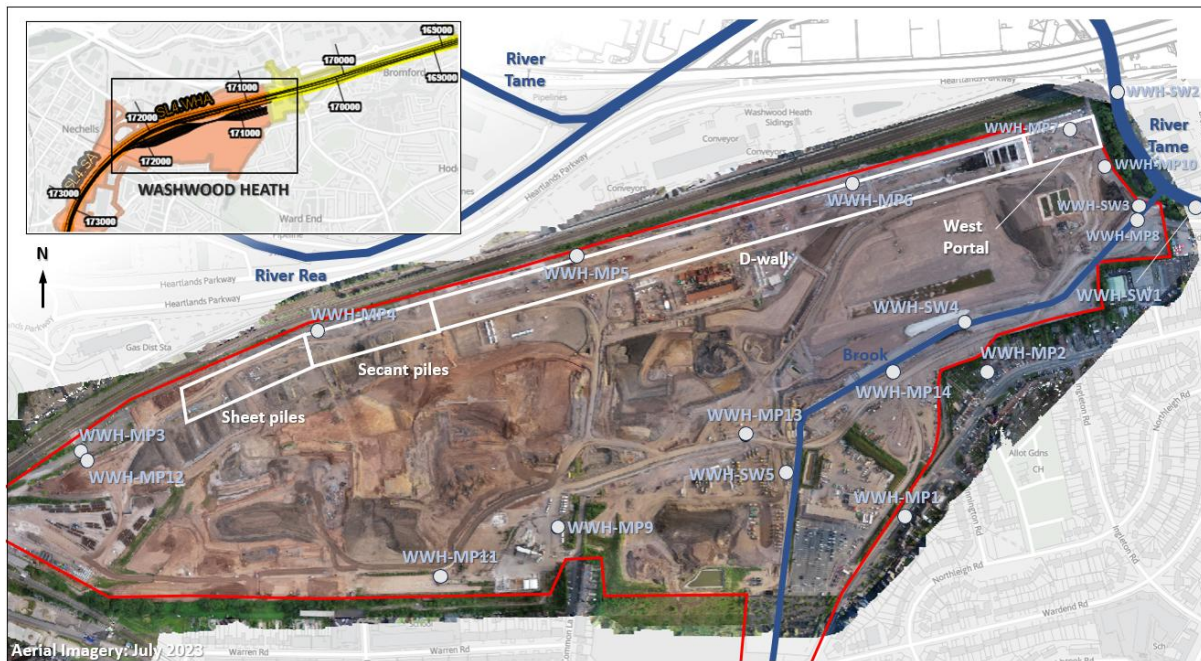
The site's historical background includes industrial use and prior occupancy by a range of businesses and facilities. Extensive ground investigations have revealed layers of mixed made ground soils, which are the primary target for soil remediation efforts. These soils are partially underlain by drift deposits over the Mercia mudstone group, with the underlying geology classified as a low productivity aquifer.

The overall scope of remediation works enabled development platforms that are environmentally and geotechnically suitable to allow onward construction. In addition to the cut and fill exercise required to construct the desired levels, because of the industrial heritage of the site, impacted soils and groundwater required affirmative remediation. Therefore, treatment of soil was required (for contamination and geotechnical purposes) and water needed to be treated similarly for contamination purposes (and for general management purposes where water may otherwise inundate excavations).

To manage contamination leaching risks to nearby controlled waters (River Tame and River Rea) from soil and from dissolved phase and mobile free product (NAPL) contamination, Site Specific Assessment Criteria (SSACs) were developed to identify ground conditions that present an unacceptable risk to Controlled Waters (via DQRA).

A network of shallow groundwater monitoring boreholes was installed to target river terrace deposits at the site boundary. Central wells (MP13 and MP14) have also been built to target the contaminant plume at the central part of the site. These wells were monitored throughout and will be after completion of the works. Both SSACs and KPIs comparing baseline conditions have been implemented as a measure as part of the quarterly reviews (commencing in 2022).

Groundwater quality observation in monitoring wells and from surface water monitoring points across the site commenced in October 2021. SSACs have generally stayed below targets for groundwater quality, with exceedance having affirmative remedial action warranted. Overall, water quality remained relatively stable and continued to generally reflect baseline conditions. Based on the data sets collected by BBV at the site, there has not been a deterioration in groundwater quality over the monitoring period and concentrations of the KPI parameters (chloride, pH, sulphate, electrical conductivity, calcium, sodium, sulphate and zinc) remain below intervention thresholds.



Plan map of WWH. The red boundary indicates the extent of remediation works and the white boxes indicate the extent of different construction activity. Groundwater monitoring boreholes (WWH-MP1 to WWH-MP14) and surface water sampling points (WWH-SW1 to WWH-SW5) are shown. The River Tame can be seen towards the north-east of site.

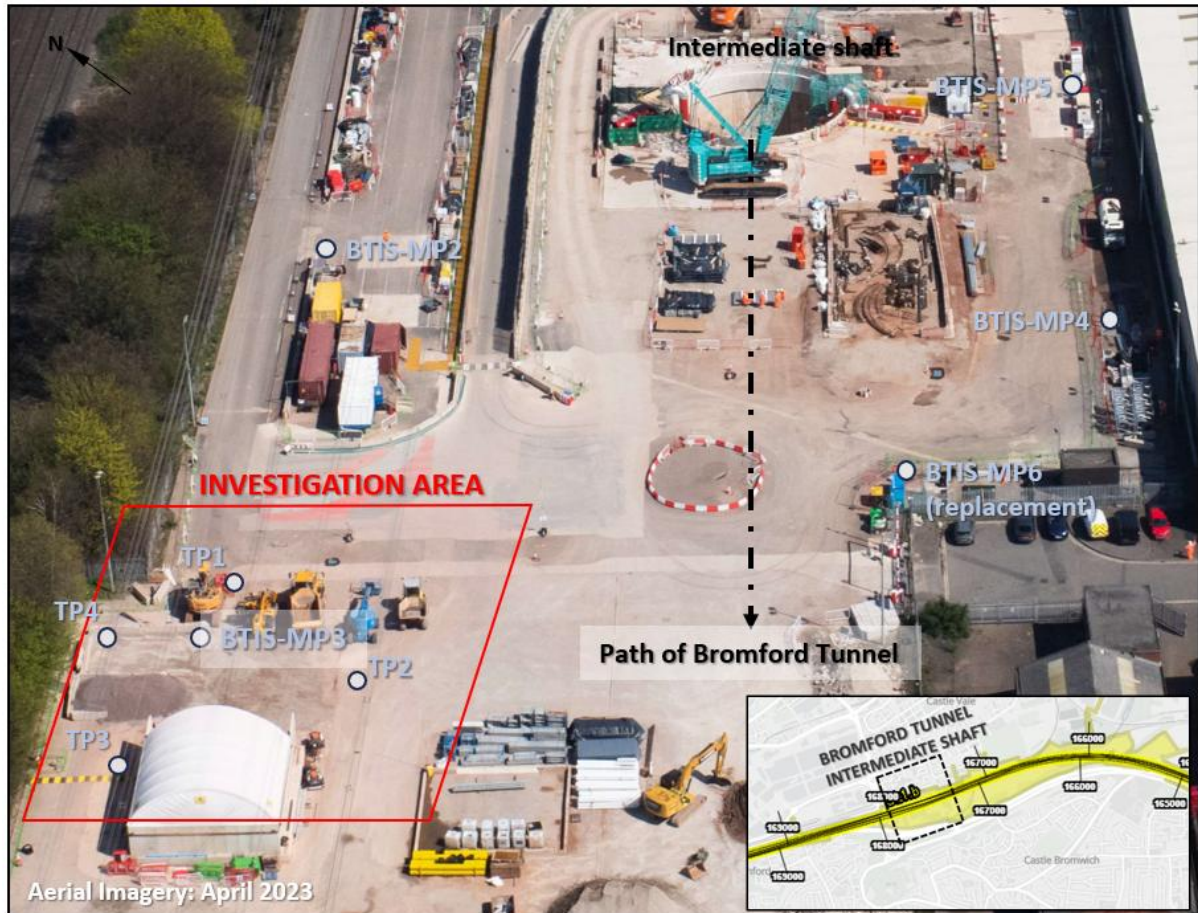
Case Study 2: Bromford Tunnel intermediate shaft (BTIS)

The BTIS site is located within an area of previously identified contaminated land associated with former land uses on Castle Bromwich Business Park. Between July 2022 and January 2023, increased concentrations of Total Petroleum Hydrocarbons (TPH) and certain polycyclic aromatic hydrocarbons (PAHs) were recorded in groundwater sampled from monitoring wells BTIS-MP3 and BTIS-MP4 (as shown in Figure 5), the reason for the increase being unknown. As such BBV undertook further ground investigation around BTIS-MP3 and a review of historic and current ground investigation data was completed at BTIS-MP4.

As part of the ground investigation, further monitoring was undertaken including ground gas monitoring and a total of four trial pits were excavated near to monitoring well BTIS-MP3. None of the shallow soil sampled exceeded the threshold set by the Detailed Quantitative Risk Assessment. In addition, risks from flammable / explosive ground gas were determined as low.

Groundwater monitoring between February and June 2023 indicated a significant decrease in TPH and PAH, with most of the results being below the laboratory method detection limit and therefore being no longer of concern. The reason for the increase of TPH and PAH in the groundwater is unknown although it is considered likely to be due to the construction works associated with the excavation of the shaft and the removal of the hardstanding at the site, allowing for an increase in leaching from the soil due to surface water ingress over the wet winter months.

DQRA indicated that there was no obvious point source for contamination and the CoCs identified in the Generic Quantitative Risk Assessment (GQRA) did not pose a risk to human health or controlled waters within the soil or groundwater unless the concentration of Total Petroleum Hydrocarbons (TPH) in the soil was above the residual soil mobility limit (C_{res}) value of 3,900mg / kg indicating that non-aqueous phase liquid (NAPL) may be present. The remediation strategy recommended that any encountered grossly contamination impacted material be removed from the site and disposed of to a licensed facility, and landscaped areas of the site be covered with at least 600mm of 'clean' cover over a geotextile marker layer and that ground gas protection was required. Therefore, with the remediation strategy mitigation measures and the fact that the majority of the site would be covered in hardstanding, the overall risk was considered to be low.



An annotated drone survey indicating the investigation area – Bromford Tunnel intermediate shaft and the pathway of tunnel. Groundwater monitoring wells (BTIS-MP2 to BTIS-MP6) and additional trial pits (TP1 to TP4) are also shown.