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CASE STUDY

Permeable Reactive Barrier Installation

Royal Wharf, London

Client

BALLYMORE

Oxley

Main Contractor

cognition land and water
leaders in land remediation

Engineering Consultants

CGL
Card Geotechnics Limited
Providing Ground Solutions

Site Background & History

The Royal Victoria Dock site comprises of three wharves – Venesta Wharf, Crescent Wharf and Minoco Wharf (from west to east) and the associated lands.

The proposal is to develop all three wharves (as the Royal Wharf Project). The overall development will become the largest new docklands regeneration project since the construction of Canary Wharf twenty years ago.

The Royal Wharf project will bring a mixture of over 3,000 apartments and town houses, retail space, cafes, a school, restaurants and a 'state of the art' gymnasium as part of the overall regeneration of East London.

The proposed Royal Wharf Development is shown in Figure 1 below.

Figure 1 – Proposed Royal Wharf Development

The Royal Wharf development sits on the site of the 'Silvertown Explosion'. A large explosion occurred on the 19th January 1917 at a munitions factory located on the site – the explosion killed 73 people, injured more than 400 and caused substantial damage to the local area. As part of the development, the Silvertown War Memorial was relocated to Royal Wharf Gardens in the centre of the development.

The waterside area has been the scene of extensive industrial development over the years.

The circa fifteen-hectare site was originally developed as an industrial works at the end of the nineteenth century and was also used for the manufacture of TNT during the First World War. Following this, the site was used by Shell UK for a period as an oil storage and refining site. This tenure came to an end in the 1990s when the site was left vacant.

The majority of the buildings on the site have been demolished and the site was generally unoccupied prior to commencement.

The prime environmental concerns were the potential risks posed to controlled waters. There were no significant risks posed to human health.

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Card Geotechnics Limited [CGL] identified metallic pollutants as the prime contaminants of concern in relation to potential risks posed to controlled waters (i.e. arsenic, copper, chromium, lead, nickel, vanadium and zinc).

Although the shallow groundwater was considered to be perched, CGL identified a potential risk to both the south of the site (River Thames) and to the north (offsite receptors).

Working with CGL, Envirotreat designed a barrier scheme to address the potential groundwater contamination pathway. The barrier scheme involved the installation of an E-Clay Permeable Reactive Barrier System [PRB] designed to intercept and treat the identified contaminants of concern.

The barrier system was designed to incorporate a site-specific formulation of pillared E-Clays - the pillaring effect provided the necessary porosity / permeability for the PRB System (in addition to a treatment capability for metallic species in anionic form i.e. arsenates / arsenites) – the majority of the metallic contaminants of concern are cation exchanged onto the clay matrix.

Methodology

Envirotreat was engaged by Cognition Land and Water to provide the installation of the agreed PRB System. The actual barrier position was agreed on site to address design issues and local constraints. The works were undertaken in three distinct phases.

Phase 1 – May 2014 - the eastern part of the barrier installation.

Phase 2 – December 2014 - the central part of the barrier installation.

Phase 3 – March 2015 - the western and final section of the barrier installation.

The barrier installation was designed to be relatively shallow to address the identified shallow groundwater present within the made ground.

The barrier installation involved the excavation of a trench extending into the underlying (relatively impermeable) clay – the pillared E-clay treatment medium was then added in slurry form as shown in Figures 2 and 3 below. Previously excavated soils were added back to the trench and soil mixed using an excavator.

Figure 2 – E-Clay Slurry Addition to Excavated Trench

Figure 3 – Delivery of E-Clay Slurry to the Barrier Installation

The barrier was installed to a maximum depth of 3.2m bgl in accordance with the prevailing site geology observed along the barrier alignment.

Due to shallow nature of the barrier installation, significant care was required in the management of excavated soils to ensure reused soils would not adversely affect the overall permeability of the shallow made ground.

Validation

The barrier was installed in accordance with the agreed design - this was verified through quality control checks during the installation and quality assurance procedures as specified in the Site-Specific Quality Plan.

Permeability testing was carried out on the soils within the barrier alignment pre and post addition of the E-Clay slurry – this was to demonstrate that there was no adverse impact on the overall permeability of the soils following the barrier installation.

Samples of both untreated and treated soils were submitted to Geolabs for permeability testing – the results confirmed that the permeability post installation was within the agreed maximum 10^{1} variation.

Conclusions

Envirotreat demonstrated through a comprehensive Validation and Verification Report that the remediation works had been carried out in accordance with the overall Remediation Strategy for the site. The prime driver for this element of the remediation works was the protection of controlled waters.

The barrier installation is shown in Figure 4 below.

Figure 4 – Barrier Installation