11 Geology, Hydrogeology and Land Contamination

Introduction and Methodology

11.1 This chapter addresses the geological and hydrogeological conditions of the project site and assesses the likely environmental effects of the project on soil, geology, hydrogeology, and surface water environments both during construction and operation

11.2 The sensitivity of the environmental setting of the site, including ground and groundwater conditions, has been reviewed in the context of the historical land uses of the site. The baseline conditions are identified and the likely significant environmental effects associated with the project are reviewed, taking into account the measures adopted as part of the project to reduce of avoid adverse effects.

11.3 Information sources used to identify land uses as part of this assessment have included:

- Site walkover reconnaissance survey: 8th December 2009;
- Phase 2 Land Quality Assessment prepared by SLR dated April 2008, which incorporates a Phase 1 Land Quality Assessment prepared by SLR dated September 2007 identifying information such as groundwater abstractions, landfill sites and pollution incidents;
- Waste Management Site licence (modification), referenced 60540M/M01 for Griffith's Road Limebeds dated April 2002;
- Permit SP3430BF to operate part of an installation at Lostock Sodium Carbonate Manufacturing Site dated October 2004;
- Site Protection and Monitoring Programme prepared by WSP dated March 2008;
- First Phase Reporting of the Site Protection and Monitoring Programme Where Reference Data is Required by WSP dated August 2009;
- Report on the Decommissioning of Lostock Power Station dated February 2001;
- Published records such as British Geological Survey (BGS) maps and Environment Agency Groundwater Vulnerability map.

11.4 The above information has been used to consider the potential risk to environmental and human receptors, including an evaluation of the probability of harm occurring taking into account identified sources of contamination, the receptors that may be affected by such contamination and pathways by which the receptors may be harmed.

11.5 Within the qualitative assessment the following terms are used:

- Source: Potential contaminant sources;
- Pathway: The mechanism by which the source may affect a receptor; and
- Receptor: Identified features that may be affected, based on the sensitivity of the site setting, in particular watercourses and ecologically important sites, taking into consideration the nature of the project.

11.6 The study has led to the development of a conceptual model and a preliminary risk assessment. The assessment will be used in due course to inform the Construction Environmental Management Plan (CEMP) for the project.

11.7 The key objectives of the assessment contamination are to:

- Summarise the existing pertinent desk study information for the site and surrounding area;
- Summarise the existing pertinent site investigation work for the site;
- Provide an assessment of the risks posed by ground and groundwater conditions, taking into account any remedial works or control measures forming part of the project;
- Provide an assessment of the effects of construction and operation of the project on the receiving environment; and
- Provide further recommendations for remedial works or other mitigation measures, if required.

Assessment of Effects

11.8 The significance of effects arising from the project has been assessed taking into account the scale (distance, area, volume, concentration etc.) and duration (short-term, medium-term, long-term) of the effect. Therefore, a localised short-term effect is assigned a lower significance level than a large-scale, long-term effect. Additionally, greater significance is assigned to potential pollution damage to the environment that is non-reversible.

11.9 The following significance criteria have been used as a guide in the course of this assessment (Based on the criteria set out in the consultation paper *Environmental Impact Assessment: A Guide to Good Practice and Procedures* (DCLG 2006)):

- Substantial: The effects represent key factors in the decision-making process. They are generally, but not exclusively associated with sites and features of national or international importance and resources/features which are unique and which, if lost, cannot be replaced or relocated.

- Major significance: Effects of the project of greater than local scale and, if adverse, are potential concerns to the project depending upon the relative importance attached to the issue during decision-making;
- Moderate significance: Effects of the project that may be judged to be important at a local scale but are not likely to be key decision making issues;
- Minor significance: Effects that may be raised as local issues but are unlikely to be of importance in the decision-making process, although they may be of relevance in the detailed design of the project.

11.10 Where an effect is described as 'neutral' this means that there is either no effect or that the significance of any effect is considered to be negligible (e.g. beneath levels of perception, within normal bounds of variation or within the margin of forecasting error).

11.11 All other levels of significance apply to both adverse and beneficial effects. In all cases, the judgement made as to significance is that of the author with reference to appropriate standards/guidelines where relevant. For the purposes of this assessment, effects of minor significance and above are considered to be significant in EIA terms. A conclusion that an effect is 'significant' should not be taken to imply that the project is unacceptable.

Measures Adopted as Part of the Project

11.12 Proposals for the control of effects have been incorporated as an integral part of the project. These proposals have been taken into account in the assessment of the effects of the project and include the following:

Construction

11.13 A Construction Environmental Management Plan (CEMP) for the project would be developed to manage effects during the construction phase. This would include the following measures.

11.14 All fuel and chemical storage would be in accordance with the Environment Agency Pollution Prevention Guidelines and would be in bunded areas with an impermeable base, capable of providing at least 110% capacity of the storage tank.

11.15 Brunner Mond has procedures in place to respond to spillages both on and off Lostock Site. The adjoining land will continue to operate in accordance with its existing PPC Permit. In addition, a project Spillage Response Plan would be developed for the construction phase of the SEP and would be implemented by the Main Contractor, in consultation with Brunner Mond. It would set out systems to ensure that pollution effects upon people, flora, fauna, land, air and water are contained and minimised and that clean-up procedures and spill kits are in place to respond effectively in the event of an incident.

11.16 It is proposed that as far as practicable, the project would achieve an approximate cut/fill balance. However, where any excess material is required to be removed from the site, efforts

would be made to identify a potential local opportunity for beneficial re-use of these materials, such as other construction projects in the area at the time. Disposal to landfill would be regarded as the final option.

11.17 Any topsoil would be removed and stored for re-use on the project site where applicable.

Foundation Design

11.18 The site is underlain by Boulder Clay over Mercia Mudstone and is not underlain by a sensitive groundwater resource. However, a detailed assessment of the geological properties would be undertaken prior to construction and should deep piles be required, a technique that minimises the risk of providing a pathway for contaminant migration from the surface to depth would be adopted. One option would be continuous flight augur, which has previously been agreed with the Environment Agency as a suitable technique for this site.

11.19 Although not underlain by an important groundwater resource, measures would be adopted during the design and construction phases of the project to ensure the design of foundations would minimise the risk of pollution during construction. Where appropriate, for example for buildings and minor structures, shallow raft and pad techniques would be used. For major structures, such as the stack and boilers, more substantial foundations would be required. These could be deep raft or shallow pile foundations founded on the Boulder Clay and Mercia Mudstone. If required, the contractor could re-engineer the existing fill or replace it with suitable granular fill on a geotextile membrane to provide adequate load bearing capability.

Contamination

11.20 Detailed assessment of the site has been undertaken, confirming the nature and extent of contamination on site. A Site Investigation was undertaken by SLR in April 2008 for a previously proposed development (see Appendix 11.2). This assessment will help towards the development of a detailed management strategy for the site.

11.21 The site also currently falls within the PPC Permit Installation Boundary held by Brunner Mond for the neighbouring sodium carbonate manufacturing site. As such, in addition to the SLR report, baseline conditions are recorded and monitored in relation to the authorised processes. A Site Protection and Monitoring Programme (March 2008) and First Phase Reporting of the Site Protection and Monitoring Programme Where Reference Data is Required (August 2009) (see Appendix 11.3) have been prepared by WSP. These reports also provide baseline conditions for the subject site. The findings of the site investigation are discussed in more detail below.

11.22 Additional contamination investigations would be required once the detailed design of the facility is complete and it is envisaged that the scope of such investigations and reporting of the findings would be undertaken as a condition of planning consent to allow the Local Authority Contaminated Land Officer and Environment Agency the opportunity to review and

comment ahead of any works being undertaken in order to minimise any risks to the environment. Where areas of contamination are confirmed through further Site Investigation work, excavation would be avoided where feasible within the design. However, where such avoidance is not possible, affected materials would be re-used on site (where practicable) or the options considered for on-site treatment of contaminated soils and/or disposal to a suitably licensed facility.

11.23 Stockpiling of any contaminated materials would be avoided where practicable. Where it is necessary, stockpiles would be located on areas of hardstanding or plastic sheeting to prevent contaminants infiltrating into the underlying ground.

11.24 Any necessary licences would be obtained for the storage, treatment and disposal of waste, using Brunner Mond's well established waste management procedures.

11.25 Excavated spoil and piling arisings would be sampled and tested, in order to assess the suitability of materials for reuse on site against site specific criteria.

11.26 Where significant unforeseen contamination is identified during the course of the work, specific investigations would be undertaken in the areas in question and appropriate action taken, in consultation with Brunner Mond and the relevant authorities.

11.27 Measures adopted to protect construction personnel would include:

- Contact with contaminated material to be avoided within the design;
- Appropriate Personnel Protective Equipment (PPE) would be used;
- The extent of surface exposed would be controlled to minimise dust and vapours and dust suppression equipment would be used where this would not provide a risk to nearby surface waters;
- Management measures would include the use of separate clean and dirty areas with welfare facilities and implementation of occupational hygiene measures.
- Data about local surface water features supplied by the Environment Agency;

Baseline Conditions

11.28 The site and its surrounding environmental context, together with detail of the project, are provided in Chapters 2 and 3 of this ES. This section focuses primarily on previous activities that have occurred within the site and its immediate surroundings in order to identify ground conditions and, in particular, the potential for contamination to be present.

Legislation and Policy Context

11.29 A summary of the key legislation and policy applicable to this assessment is provided in Appendix 11.4.

Project Site Description

11.30 The site is located on land at the former Lostock Power Station site (which ceased operating in September 2000 and is now redundant), and comprises:

- The main site containing the former boiler and turbine halls and associated plant including water treatment plant, together with a series of offices and ancillary buildings (the majority of the area is identified as Area 6 in the PPC Permit SPMP with Area 8 to the north). The main site is crossed by a series of pipe bridges and culverts carrying live steam, electricity and effluent services. A series of transformers associated with the former power station also remain in-situ. This area would be subject to demolition and would contain the main development site for the project;
- A coke storage yard, located 200m west of the main site which would be used for fuel reception (delivered by rail) and an ash treatment facility (identified as Area 5b);
- Rail sidings alongside the fuel reception yard (identified as Area 5a);
- An area of undeveloped land and partially surfaced land to the east of the canal to be used for construction lay down; and
- An area comprising undeveloped land and pipelines, located approximately 200m north of the main site which is also included in the application for the relocation of the coke storage yard.

11.31 The site forms part of the existing Brunner Mond sodium carbonate manufacturing site, which is adjacent to a number of other industrial operators including Solvay Ltd and Ineos Chlor. Other areas in close proximity to the site to the south and east comprise lime beds associated with the works and bare ground with sections of dense and scattered scrub together with semi-improved grassland beyond.

11.32 The Trent and Mersey canal runs north/south through the site. It is used by pleasure craft only and for no current commercial uses.

Historic Land Uses

11.33 The site is located in an area that has been used for the production of bleach and soda ash since the late 1800s. Much of the surrounding land, particularly to the south and east, has also been used for lime waste disposal. During the First World War it is understood that ammonium nitrate production for use in explosives was undertaken at the soda works.

11.34 A review of the historic Ordnance Survey maps was undertaken by SLR in 2007, a copy of which is appended (see Appendix 11.2), and which can be summarised as follows:

Table 11.1: The Main Site (Former Power Station)

Dates	Description
1880 - 82	Enclosed fields
1898 - 99	Land raise (lime waste)
1954	Four structures present on site
1964	Two long buildings (boiler house and turbine house)
1971	Building in corner of the site is removed
1986	Tank shown on site
1999	No apparent changes to site

Table 11.2: The Coke Storage Yard

Dates	Description
1880 - 82	Enclosed fields
1910 - 11	Rail sidings
1954	Rectangular building on site (chlorine plant with asbestos cells, used between the 1950s and 1980s)
1986	Site building cleared

11.35 The site has been previously used for the disposal of lime waste but between 1940 and 1950 the lime deposits were cleared from the area and the land redeveloped as a coal fired power station. Only traces of the original lime deposits can now be detected in core samples. The power station was taken out of commission in 2000 having previously provided heat and power to the adjacent chemicals complex (formerly part of ICI, now occupied by Brunner Mond, Solvay Chemicals and Ineos Chlor). No other chemical manufacture has been undertaken on the project site.

11.36 The historical map extracts record evidence of a long history of industrial activity on the site. Discussions with site management at Brunner Mond confirm that a waste lime bed was located beneath the current boiler house but it is believed that most of the material was excavated when the building was constructed in the 1960s.

Site Management

11.37 The Lostock sodium carbonate (soda ash) manufacturing site is regulated by the Environment Agency in accordance with Permit SP3430BF. This includes the area subject to the current assessment. The production of soda ash, known as the Solvay ammonia soda process, uses raw materials of brine (sodium chloride solution), limestone (calcium carbonate) and coke which are converted into sodium carbonate and calcium chloride solution. The process requires significant energy and heat input, originally provided by the coal fired power station on the subject site but now replaced by a combined heat and power plant operated by E.ON CHP (UK) Ltd at Winnington.

11.38 The Brunner Mond ammonia-soda process supplies calcium hydroxide suspension ('milk of lime'), carbon dioxide gas and aqueous ammonia by pipeline to the calcium carbonate plant operated by Solvay Speciality Chemicals Ltd on the same site. The Brunner Mond effluent treatment beds are situated to the east of the main works. Aqueous discharges are released to Wade Brook containing chloride, ammonia, suspended solids, phenols, cresols, and cyanide (existing consents at very low concentrations). Settled solids derived from the effluent treatment plant are transferred by pipeline for deposition in a previously solution mined brine borehole located at Holford Brinefields.

11.39 The proposed use of the site as an SEP will also be a permitted activity (requiring an Environmental permit). Consequently it will be necessary to apply for a partial surrender and new permit, or partial transfer and subsequent modification to reflect the proposed activities. In order to accept a surrender application, the Environment Agency would need to be satisfied that the site does not represent an unacceptable risk to the environment and that site conditions have not materially changed since the original baseline investigation (see Appendix 11.2).

11.40 Being a regulated site, the Environment Agency (EA) will have undertaken periodic inspections. The EA also requires Brunner Mond to implement an Improvement Programme, which as of 20th March 2008 required a Site Protection and Monitoring Programme (SPMP, see Appendix 11.3).

Potential Sources of Contamination

11.41 The following features have been identified based on a review of current and historic mapping, and subsequent site walkover conducted on 8th December 2009. The Site Protection and Monitoring Programme (SPMP - Appendix 11.3) also identifies potential contaminants that may arise as a result of the permitted activities.

11.42 Potential contamination sources on site are as follows:

- Made ground across the site that may be contaminated with a range of substances, including metals, inorganics, such as cyanides, petroleum hydrocarbons, alkaline conditions and asbestos.
- The made ground, in particular where lime waste is present, may be a source of ground gas comprising methane and carbon dioxide. However, Brunner Mond has advised that the area of lime deposition on the project site was excavated prior to the development of the existing structures.
- Chlorine plant located on the coke storage area between 1950s and 1980s.
- Coke storage, exposed to rainfall, giving apparent sheen on ponded water, but no records of pollution associated with this activity.

- Local accumulations of ash associated with the power station may remain adjacent to the precipitators and hoppers and in the lime waste.
- PCBs and mineral oils may be present around the transformers and substations to the east of the turbine house. Any PCBs present would relate to historic transformer oil spillage (no such records of spillage exist).
- Oil storage tank as a back up fuel (in place of coal) previously located to the south of the Boiler House, upon a large concrete pad.
- Lubricants and cleaning chemicals associated with the turbines and boilers appear to have been stored in the building or imported on site as necessary.
- A small redundant above ground diesel tank situated within a concrete bund to the rear of the former chimney.
- Oil store (drums): A building to the southeast of the offices formerly housed an oil store.
- Ballast materials historically deposited for railway sidings, which may include boiler ash.
- Potential for asbestos to be present in the buildings fabric.
- Coal waste: associated with the former coal storage between 1984 and 1987 on the car park adjacent to the main site access road (although solid coal is not considered to be a significant source of contamination until processed).

Surrounding Land

- Burnt lime and milk of lime production associated with existing permitted process.
- Soda ash kilns: workshop areas are connected to soda ash kilns north of the Boiler House.
- Lime beds
- Former chemical waste landfill located to the southwest, 250m from the site.

Environmental Setting

Topography

11.43 The topography of the site and the Brunner Mond works to the north is generally level. There is a slight south westerly slope towards the existing coke storage area (proposed for the rail reception facility and ash treatment facility associated with the SEP) and a very gradual south easterly slope near to the the site entrance. The piece of land to the south east of the works (Council owned and south of the land formerly used for coal storage) is positioned at a lower level than the surrounding land, with a small bank running along the west and a bank to the east, across from the road. Land immediately north of the Brunner Mond works, near to the

brine purification plant, slopes in the direction of the reservoir/ cooling ponds and land positioned further north (proposed for future coke storage) is situated at a slightly higher level, with banks sloping down to the east situated along the canal.

Geology

11.44 Reference to the British Geological Survey sheet for the area (BGS Sheet 110, Macclesfield, scale 1:50,000 indicates that the underlying geology comprises surface drift deposits of Boulder Clay overlying solid geology of Mercia Mudstones. Brunner Mond records, inspected by SLR, indicate that the geology at the site comprises up to 3.00m of made ground including lime waste, overlying Boulder Clay and Mercia Mudstones. The published geological drift map of the area (British Geological Survey sheet for the area, BGS Sheet 110, Macclesfield, 1:50,000) indicates that the site is overlain by glacial deposits which comprise Boulder Clay but also post-glacial alluvial deposits which occur to the north of site boundary and are associated with Wade Brook. The alluvial deposits comprise glacial sands and gravels.

11.45 The site is located upon upper Permo-Triassic (Keuper) age bedrock, comprised of mudstone-dominated lithologies of the Mercia Mudstone Group. The Mercia Mudstone Group comprises Upper Keuper Saliferous Beds, Middle Keuper Marl, Lower Keuper Saliferous Beds and Lower Keuper Marl.

11.46 The two main types of made ground strata encountered on site during SLR's intrusive investigation include:

- Made ground comprising loose black sandy fine to coarse gravel ash and clinker with rare gravel of red brick from ground level to depths of between 1.0m and 3.2m below ground level (bgl). The ash was found in all boreholes except BH3 and BH5 in the east of the site and BH9 in the coke storage yard.

- Made ground comprising light greyish white silt identified as lime waste. The lime waste was recovered as a waterlogged sludge. The lime waste was encountered beneath the ash deposits at depths of between 0.7m and 3.2m bgl in all boreholes except BH8 and BH9 in the south of the site and the coke storage yard, where no lime waste was encountered. A thin layer of lime waste was encountered between ash at the surface and clay beneath in BH10.

11.47 The site is bisected by a geological fault, known as the 'King Street Fault' which runs broadly north to south through the site running approximately parallel to the western boundary of the site. Saliferous beds of the mudstone lie to the west of the fault and their maximum thickness may reach 9.1m. Middle Keuper Marls lie to the east of the fault whose thickness ranges between 36.5m and 57.9m. The geology of the coke storage yard comprises boulder clay overlying the saliferous beds of the mudstone.

11.48 Construction drawings for the foundations of the Lostock Boiler House Extension viewed by SLR during the 2004 site visit indicate that the shallow geology beneath the power station site consisted of 0.3m of Ashes over 2.0m of Old Lime Bed over 0.6m of original topsoil and organic clay overlying Boulder Clay. The chimney foundations were constructed in the top of the Boulder Clay. Borehole records from 1970 in the location of the former fuel oil storage tanks indicate the presence of 0.60m of ash, over 0.15m to 2.00m lime waste. Firm clay was encountered between 2.70m to 3.50m bgl. Bedrock, described as Marl, is indicated at 10.70m bgl. A borehole in the access road indicates shallow deposits of ash (0.03m) over lime waste (described as very soft) to 0.76m, over ash and cinders to 1.37m bgl. Boulder clay was encountered at 1.83m. A pH of 12 was measured in the lime waste. No borehole records were available for the coke storage yard for SLR to review.

11.49 The borehole records indicate that in the vicinity of the boiler house the made ground is shallow and stiff clay is present between 1.00 and 3.50m bgl.

11.50 Groundwater strikes were recorded in one borehole beneath the fuel storage area at depths of 1.37m and 1.45m.beneath the lime waste. Borehole records for other parts of the Brunner Mond site indicate that groundwater was encountered within saturated lime waste, perched above clay.

11.51 The British Geological Survey (BGS) records that compressible ground subsidence hazards are moderate to high.

11.52 The Coal Authority reports that the site is within an area that may not be affected by coal mining. BGS notes that the risk of shallow mining hazards and natural subsidence hazards are low.

11.53 The site is in an area which might be affected by brine subsidence though the BGS record that the ground dissolution hazards are low to moderate.

Hydrogeology

11.54 The Environment Agency Groundwater Vulnerability Map Sheet 16, West Cheshire, 1:100,000, has classified the Mercia Mudstones beneath the site as a non aquifer. Non aquifers are generally regarded as containing insignificant quantities of groundwater. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered in assessing the risk associated with persistent pollutants. Some non-aquifers can yield water in sufficient quantities for domestic use and provide base flow to rivers. Mercia Mudstone groups, although identified as non-aquifer, can contain up to 49% sandstones and act as a minor aquifer although they also can contain bands of halite which act as barriers to the percolation of water and the contamination of “ground water”.

11.55 The physical properties of major aquifers in England and Wales (British Geological Survey) confirm that Triassic Mercia Mudstone Group, which forms the upper part of Permo-Triassic

sequence in the region, is classified as aquitard, and overlies the Sherwood Sandstone Group. Major or minor aquifers may occur beneath non-aquifers.

11.56 Superficial drift deposits which overlie the solid geological strata can sometimes be substantial in thickness. They are always variable in composition changing from highly permeable outwash gravels to low permeability clays over short distances both laterally and vertically. The presence of low permeability drift deposits at the surface is identified by stipple shading.

11.57 Any groundwater beneath the site is considered to have been formed via precipitation or direct discharge to ground (hot water sump) and leaching through permeable made ground and will be perched above the underlying natural clay deposits.

11.58 There are no licensed groundwater abstractions or source protection zones within 1km of the site centre. One licensed groundwater abstraction is recorded for a location 1.6km from the site.

11.59 The Environment Agency website (www.environment-agency.gov.uk) confirms that the site does not fall within a Source Protection Zone.

Hydrology

11.60 The closest surface water course is the Trent and Mersey Canal which forms the eastern boundary of the site. The canal is classified as River Ecosystem class 4 (fair quality).

11.61 Wade Brook flows from east to west 125m north-west of the current Power Station site boundary and passes beneath part of the Brunner Mond operational site in a culvert. It is classified as River Quality Grade F (bad). Brunner Mond has previously had a temporary abstraction from Wade Brook for cooling located approximately 300m north of the site.

11.62 There are three other licensed surface water abstractions within 1 km of the site with two registered to British Waterways (400m north of the site from the Trent and Mersey Canal) and the third by Ineos Chlor Ltd (880m northwest of the site from Wincham Brook).

11.63 The project site does not lie within a fluvial indicative floodplain.

11.64 Several pollution incidents to Wade Brook over the past decade have been attributed to Brunner Mond including diesel and chemical spills.

Ecologically Sensitive Land Use

11.65 There are no nationally or internationally designated ecological receptors within 1 km of the site boundary

Human Receptors

11.66 The site is located on an existing industrial complex. New residential properties are located south of the site, between 300 and 350 metres.

Other Issues

11.67 The Coal Authority reports that the site is within an area that may not be affected by coal mining. BGS notes that the risk of shallow mining hazards and natural subsidence hazards are low.

11.68 The National Radiological Protection Board (NRPB) reports that less than 1% of homes are above the Action level for radon gas and that no radon protection measures need to be installed.

Previous Investigations

11.69 A summary of previous site investigations undertaken for the project and surrounding area is provided below.

Report on the Decommissioning of Lostock Power Station

11.70 A report was prepared in 2000 at the time of the decommissioning of Lostock Power Station. The report, prepared by the Power Station Decommissioning Manager, documented the decommissioning activities following the closure of the site on 18th September 2000 for use in future tender enquiries for demolition of the Power Station.

11.71 The report documents that the site comprised 5 boilers, three of which were oil fired and two run on pulverised coal with support heavy fuel oil. The decommissioning included the emptying of the coal handling conveyors and bunkers, mills and feeders. Lubrication oil was removed from all the gearboxes, pumps and bearing assemblies. The fly ash hopper was emptied and mixing tank flushed out with slurry disposed off site.

11.72 Much of the steam mains are asbestos lagged, but there is reference to an asbestos register available for the site detailing the location of all such materials and where accessible has been labelled. Asbestos insulation associated within boiler casings is thought to have been removed in previous boiler refurbishments.

11.73 The HRO fuel and gas oil systems had been decontaminated by Limpia Waste Management with the supply mains removed and two external stock tanks to the south of the building emptied and cleaned out (and since removed).

11.74 The chemical dosing system for the boiler feed water, which comprised bulk tank units, dosing pumps and dosing lines and boiler unit were flushed through and decontaminated by Nalco Ltd.

11.75 The report concluded that there should be no source of contamination into the Power Station land drains.

Site Protection and Monitoring Programme prepared by WSP dated March 2008.

11.76 The SPMP report provides details of the site operation and potential sources of contamination in relation to the permitted activities. The report comments that Brunner Mond operates an Environmental Management System certified to ISO14001.

11.77 The report identifies that a target intrusive investigation will be undertaken within the installation area (i.e. covering the entire permitted area and not just the current project site), comprising 11 window samples to depths up to a maximum 5.0m bgl.

11.78 The target areas for the investigation are identified with regards to potential source of contamination resulting from the permitted activities. The following borehole samples were positioned within the application site:

- WS 1 – service zone (rail siding). Diesel tank with evidence of minor spillage around dispensing point.
- WS 4 – service zone. Diesel tank with evidence of minor spillage around dispensing point.
- WS7 – service zone. On northern boundary of application site. Evidence of oil spillage from decanting of oil waste into IBC (intermediate bulk container).
- WS9/WS9a – Zone 6. Brine stock tank and pipeline. Potential for failure or overfilling of stock tank or failure of pipeline when transferring the brine to point of use.
- WS10 – Zone 5a. Limestone stockpile. It is not considered that there is a reasonable likelihood of pollution from this activity.
- WS 11 – Zone 5b. Coke stockpile. It is not considered that there is a reasonable likelihood of pollution from this activity.
- WS12 – Zone 5a. Coke and limestone stockpiles. It is not considered that there is a reasonable likelihood of pollution from this activity.

11.79 The following contaminant suite was identified for both soil and groundwater; pH, mercury, sodium, cyanide, calcium, phosphates, phenols, total petroleum hydrocarbons (TPH) and poly aromatic hydrocarbons (PAH) and for water samples also chloride, ammonium, sulphate.

First Phase Reporting of the Site Protection and Monitoring Programme where Reference Data is Required, dated August 2009.

11.80 The ground investigation took place in September 2008. Made ground was encountered in all samples, consisting of mixed lithologies and in some locations it contained sandstone, ash,

concrete, clinker, brick, coke, slag, cobble and asphalt. A white paste material (lime waste) was observed in WS04 and WS12 (in the service zone in the north of the site / Zone 5b by the limestone stockpile).

11.81 No significant visual evidence of widespread contamination was observed. A minor hydrocarbon odour was noted between 2.75m and 2.85m in WS01 (where there is a diesel tank with evidence of spillage around the dispensing point) and between 0.3m and 0.5m in WS07 (where there is evidence of surface spillage from decanting of oil).

11.82 Elevated concentrations of poly aromatic hydrocarbons (PAH) were identified in soil samples from WS11 and WS12. This contamination was considered potentially to be the result of coke residues although most of the contamination is likely to be due to ash from incomplete combustion, a result of historical activities.

11.83 Slightly elevated concentrations of Total Petroleum Hydrocarbons (TPH) were identified in the groundwater samples from WS10, WS11 and WS12. Hydrocarbons are not used in the area where WS10 is located therefore it is considered that these concentrations are a result of historical activities.

11.84 Elevated concentrations of calcium were identified in the soil sample WS12, considered to be associated with the limestone.

11.85 High pH (alkaline conditions) was identified in the groundwater samples from WS11 and WS12, likely to be associated with waste from historical activities or from limestone in WS12.

11.86 Overall, the concentrations of calcium and the high pH were considered to be likely to be associated with waste from historical activities rather than from the storage of limestone. The slight elevation of PAH and TPH was also considered to be due to ash from incomplete combustion, a result of historical activities.

11.87 The report concluded that there is only slight effect on ground and groundwater which was the result of historical activities. Therefore, from an operational perspective it was not considered necessary to propose any additional measures to prevent deterioration of the land in those locations due to surface mixing, leaching or other deposition but will continue with good stockpile management practices.

Phase 2 Land Quality Assessment, prepared by SLR (2008)

11.88 SLR undertook a desk study and intrusive site investigation in support of a previous proposal to develop a waste management facility on the application site. SLR refer to the drilling of a large number of boreholes across the site when the entire site was owned by ICI. Records of borehole logs and location plans are kept by Brunner Mond and were reviewed by SLR. There is also reference to three reports by ERM Consultants dated 1991, 1994 and 1996 but these reports were not available to SLR to review.

11.89 The investigation comprised ten solid stem rotary boreholes were drilled to depths between 3.50m and 7.00m bgl. The locations of the boreholes are shown in the appended report and were as chosen as follows:

- Boreholes 01 to 03: north of the site (offices, former diesel tank and water treatment plant);
- Boreholes 04 and 05: central area by power plant (chimney / boiler house and transformers);
- Boreholes 06 to 08: south of the site (diesel tanks);
- Borehole 09: in the coke storage yard;
- Borehole 10: in the car park at the southern end of the site.

11.90 Ground conditions across the site were typically ash and clinker up to 2.9m thick overlying saturated grey lime waste to a maximum depth of 6.0m bgl. Natural soft sandy clay deposits were encountered beneath the lime waste in most locations.

11.91 Chemical testing of the soil samples collected form the made ground and the natural clay deposits indicated that the level of contamination is low in relation to the proposed development. Groundwater analysis indicated localised impacts with petroleum hydrocarbons, copper and selenium, PAH and ammoniacal nitrogen near a former diesel storage tank (BH2 in the north of the site) and PAH in BH8 near a former diesel tank on the south of the site. Given the industrial setting these groundwater impacts were not considered to be significant.

11.92 Methane concentrations were elevated in BH7 and BH10 and concentrations of carbon monoxide were elevated in BH4. Further gas monitoring was recommended to ensure appropriate gas protective measures are designed.

11.93 It was envisaged by SLR that additional contamination investigation would be required once the detailed design of any proposed development was completed and current disused infrastructure had been cleared.

Construction Assessment

SEP

11.94 Construction of the SEP is anticipated to have a duration of approximately three and a half years, with 2015 as the commencement date for waste fuel imports to the site. In addition to the main SEP site, a construction laydown area would be required, which would be accommodated on land immediately to the east (former coal storage area and land owned by the Council).

11.95 The main site is generally flat and a substantial site levelling exercise is not envisaged. However, following demolition of the existing buildings and site clearance, there would be

excavations to remove existing structures and infrastructure and for new foundations, including the bunker and stack. A cut and fill exercise would be carried out to ensure that as far as practicable removal of surplus fill material is minimised and that an approximate cut and fill balance is achieved.

11.96 The project would require demolition of the existing buildings once all asbestos has been removed in controlled conditions. The Decommissioning Report, prepared in 2000 when the power station closed, documents the removal of hazardous substances (excluding asbestos) and cleaning of the residual equipment to ensure that the site is left in a safe condition. An asbestos register is held by Bruner Mond and any remaining accessible asbestos materials have been labelled. Prior to demolition, full Type 3 surveys and removal of such materials would be undertaken by appropriately licensed contractors.

11.97 Main site roadways and drainage systems would be installed at an early stage. Construction of the access road would be a priority in order to provide a suitable route into the site for construction traffic at the earliest opportunity.

11.98 The previous desk studies and investigations have not identified a significant risk of widespread contamination on the site although there is the potential for localised hotspots. Where areas of contamination are confirmed through further Site Investigation work, excavation would be avoided where feasible within the design. However, where such avoidance is not possible, affected materials would be re-used on site where possible or the options for on-site treatment of contaminated soils and/or disposal to a suitably licensed facility would be considered.

11.99 Structures on the main site would require appropriate foundation design. Some piling is likely to be required and may include the use of continuous flight auger piles and driven sheet piles to support deep foundations.

11.100 A key element of the civil works phase would be the construction of the reinforced concrete bunker. Further reinforced concrete works would be required in the construction of the elevated tipping hall and access ramp. The previous investigation by SLR also raised the possible consideration of the use of gas protection measures. However, this would need to be subject to further investigation once the detailed design is known.

11.101 Steel framed structures such as the boiler house, tipping hall and turbine hall would be erected at a time to match the equipment installation.

Ground Conditions: Preliminary Risk Assessment

11.102 The potential existing contamination on the site may have the following effects:

- Impact on construction fabric;

- Ability to re-use excavated material and possible need for off site disposal as non inert waste;
- A potential risk to workers and future site users.

11.103 Construction activities also have the potential to result in mobilisation of contaminants and creating a preferred pathway for migration of contaminants within the ground to environmental receptors. Substantial excavations would also be required to remove existing structures and infrastructure and for new foundations with the associated risk that contaminants, if present, could be mobilised by the excavation activities. Construction workers could also be exposed to contaminated ground.

11.104 Overall, it is considered that the presence of contaminated soils represents a low risk, particularly to construction workers. However, measures forming part of the project would ensure that these risks are further minimised to an acceptable level, such as the use of appropriate personal protective equipment (PPE) and procedures will limit this risk.

11.105 Development of the project site provides the opportunity to address any existing contamination. Excavation of contaminated soils and remediation, if required, as part of the project would mitigate existing risks associated with contamination which would result in a moderate beneficial effect. The need for such works will be identified in the further intrusive investigations to be undertaken after the demolition and clearance of the site, and during development earthworks should any previously impacted materials be encountered.

11.106 Overall, the environmental effect on ground conditions resulting from the construction works for the project is considered to be neutral to moderate beneficial due to the opportunity for remediation of existing contamination with a range of appropriate control measures in place to ensure no mobilisation of contaminants occurs. This would be the case particularly where a strategy can be adopted that gives a cut/fill balance and retains the excavated soils on site. This strategy conforms with planning and permitting requirements to bring about a safe development whereby the site conditions are well documented and the residual condition is not be capable of being determined as contaminated land under Part IIA of the EPA 1990.

Grid Connection

11.107 The proposed grid connection would be via laying buried cable under a cycleway alongside the A556 and A530 between the project site and the Hartford Sub Station. This route crosses watercourses including the Weaver Navigation (a canal) and the River Dane. As a result the cable may be laid via horizontal directional drilling techniques beneath these features.

11.108 The cable route would pass alongside existing roads (within the cycleway) and is not identified as crossing through any known contaminated land or landfill. Therefore, there is no reason to believe that significantly contaminated soils would be encountered during excavations to lay the cable.

11.109 The excavations and drilling work would result in some waste arisings but this would be minimised with replacement in the open trench. Should any potentially contaminated material be encountered this would be sampled and analysed to allow an assessment of its suitability for re-use as trench fill. If deemed unsuitable, the material would be removed to suitable disposal facility.

11.110 The effect associated with the grid connection is considered to be neutral.

Operational Assessment

SEP

11.111 Following construction, the residual ground conditions are not considered likely to have any future risk to the environment or the proposed use, with the development controlled with appropriate levels of investigation, remediation (where necessary) and subsequent validation. It is considered appropriate that such measures are undertaken once the detailed design of the facility has been developed as a condition of planning consent.

11.112 The operational use of the site would require a permit, to be issued by the Environment Agency in accordance with Pollution Prevention and Control (PPC) Regulations 2000. To obtain a permit, the applicants will be required to identify all conceivable sources of contamination and appropriate containment or mitigation measures. The ongoing operation would be subject to regular inspections by the Environment Agency and appropriate Improvement Programmes. Consequently the future risk of contamination resulting from the proposed use is considered low.

11.113 During operation of the SEP, waste waters may be created from the process in the following areas:

- Water from the boiler drains;
- Wash down water from surface cleaning;
- Surface waster on potentially contaminated areas (road and hardstanding);
- Leachate from the bottom ash storage area.

11.114 Where possible water from the plant would be recycled for re-use in either the SEP or in the Brunner Mond processes. Contaminated or unusable water would be directed to an existing on site effluent treatment plant.

11.115 During operation the site would result in some potentially contaminated aqueous output and could also give rise to risk associated with the storage and use of hazardous materials on site. Site management procedures would ensure that the risk of contamination resulting from spillage on site (with resulting potential for effects on surface and groundwater) would be minimised. The project incorporates a drainage system to collect and manage any polluted

runoff. The drainage from the site would include appropriate treatment for the aqueous discharges, monitoring of drains and final testing of the site discharge and removal of suspended solids prior to discharge to the outfall. In this way, the SEP site would not have a significant effect on the local hydrology.

11.116 As identified above, any existing contamination at the site would be remediated appropriately following a risk assessment. As a result, the risk of contamination from existing sources during the longer-term operation of the SEP would be reduced compared to the current situation.

Groundwater Quality

11.117 There is considered to be the potential for a minor beneficial effect on groundwater as a consequence of the project due to the remediation or removal of existing sources of contamination on the site. In addition, the development of a new site drainage system would reduce the risk of effects on groundwater quality compared to the existing system.

11.118 Any risk to groundwater during operation is considered to be low but could include:

- Hazardous materials stored and used on site and accidental spills or leaks. This would be controlled by site management measures together with appropriate treatment of discharge from those parts of the site including potentially hazardous uses;
- Contaminants in runoff from roads, car parks and areas of hardstanding migrating to underlying groundwater. This would be controlled by the collection and treatment of runoff from these areas prior to discharge;
- Chemicals in pesticides and herbicides used on site. The use of such chemicals is likely to be limited.

11.119 Operational areas of the site would be located on hardstanding/impervious surfacing, which would limit the potential for contaminated runoff migrating to underlying groundwater. Rainwater runoff would be controlled through the site drainage system with use within the SEP and as such the potential for any contamination would be limited. Storm water would be subject to appropriate treatment prior to discharge from the site.

11.120 The overall significance of the effect of operation on the groundwater is considered to be neutral.

Grid Connection

11.121 From an operational perspective, once the cable is laid there would be no residual contaminated land issues. Future maintenance may be required which could include excavations to expose the existing cable. This however is unlikely and in any event would only require the re-excavation of material already exposed and previously deemed suitable for replacement back in the trench.

11.122 The cable route would be alongside existing roads and not via known contaminated sites or landfills, and therefore there is no reason to believe the cable route would provide a preferential route for the migration contaminants or landfill gas.

11.123 The overall significance of the effect of operation on the groundwater is considered to be neutral.

Future Closure and Decommissioning of SEP

11.124 To facilitate the redevelopment of the site the ground conditions would be further investigated and remediated as required to ensure that the site is suitable for any future proposed use with no risk to the environment. The site investigation and validation reports prepared for this purpose would provide baseline conditions for the permit that will be required for the proposed use. The site would be required to operate in accordance with its permit and would be regulated by the authorities to ensure that the future risks to the environmental are avoided. On closure the permit would need to be surrendered with the site returned to the baseline condition.

11.125 Any future decommissioning process would be subject to appropriate control and the risk to ground and groundwater would be no greater than that during the construction phase.

Recommendations for Further Mitigation

11.126 The site is considered suitable for the proposed development with no significant widespread contamination indentified in previous investigations. As set out above, a review of the asbestos register would be undertaken prior to demolition of the existing buildings and further detailed investigation would be undertaken to confirm the presence of any hotspots of contamination and inform an appropriate remedial strategy to ensure that the risk are managed to minimise the potential impact on the environment or human health. Such investigations would be undertaken in full consultation with the authorities as a condition of planning consent.

11.127 It is not considered that any further mitigation measures would be required.

Cumulative Effects

11.128 Cumulative effects can be defined as effects that may arise from a combination of the effects arising from the project with those of other existing or planned developments in the area. A number of these other developments would also lie in close proximity to the Trent & Mersey Canal and Wade Brook.

11.129 The SEP is considered to have some potential to make a minor contribution to the overall improvement in quality of the ground conditions and, in turn, potentially to the quality of groundwater and surface water through the remediation of existing contamination.

11.130 The project is not considered to represent a significant risk in terms of future contamination of soils, groundwater or surface waters due to the adoption of a range of best practice control measures and appropriate site drainage. Therefore, the project is not considered to have a significant contribution to any cumulative adverse effect on these features in relation to ground conditions and hydrogeology