Riverside Energy Park

Environmental Permit Appendices

APPENDIX:

B

SITE CONDITION REPORT

December 2018 | Revision 0 |

CORY
RIVERSIDE ENERGY

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1 Introduction

1.1.1 Cory Environmental Holdings Limited (trading as Cory Riverside Energy) (Cory or the Applicant) is applying to the Environment Agency (EA) under the Environmental Permitting Regulations (EPR's) for an Environmental permit (EP) to operate an integrated Energy Park, to be known as Riverside Energy Park (REP). REP would comprise waste treatment facilities together with an associated Electrical Connection.

1.2 Project Description

1.2.1 A detailed description of REP is presented in Sections 1.4 - 1.6 of the supporting information. REP would be constructed on land immediately adjacent to Cory's existing RRRF, within the London Borough of Bexley and would complement the operation of the existing facility. It would comprise an integrated range of technologies including: waste energy recovery, anaerobic digestion, solar panels and battery storage. The main elements of REP would be as follows:

- Energy Recovery Facility (ERF): to provide thermal treatment of Commercial and Industrial (C&I) residual (non-recyclable) waste with the potential for treatment of (non-recyclable) Municipal Solid Waste (MSW);
- Anaerobic Digestion facility: to process food and green waste. Outputs from the Anaerobic Digestion facility would be transferred off-site for use in the agricultural sector as fertiliser or as an alternative, where appropriate, used as a fuel in the ERF to generate electricity;
- Solar Photovoltaic Installation: to generate electricity. Installed across a wide extent of the roof of the Main REP Building;
- Battery Storage: to store and supply additional power to the local distribution network at times of peak electrical demand. This facility would be integrated into the Main REP building; and
- On Site Combined Heat and Power (CHP) Infrastructure: to provide an opportunity for local district heating for nearby residential developments and businesses. REP would be CHP Enabled with necessary on site infrastructure included within the REP site.

1.3 The Objective

1.3.1 The objective of this report is to provide details of the existing ground conditions for the land within the Installation Boundary.

1.3.2 This report uses various sources of background information which are provided as Appendices to report on the baseline ground conditions within the Installation Boundary:

- Envirocheck Report, dated 15 March 2018 (Appendix A);
- Wilkinson Associates (1992), Report on Site Investigation at Waste to Energy Incineration Plant, Belvedere (Appendix B.1);
- Wilkinson Associates (1992), Report on Site Investigation at Chitty Site, Waste to Energy Incineration Plant, Belvedere (Appendix B.2);
- Wilkinson Associates (1992), Report on Site Investigation at Greenham Site, Waste to Energy Incineration Plant, Belvedere (Appendix B.3);

- Applied Environmental Research Centre Ltd (2003), Site Investigation and Remediation Proposals, Ref: C3477/R1384 (Appendix B.4);
- Soil Mechanics Ltd (2007), Factual Report on Ground Investigation, Ref: G7061 (Appendix B.5);
- Applied Environmental Research Centre Ltd (2003), Site Investigation and Remediation Proposals, Ref: C3477/R1384 (Appendix B.6);
- AMEC Earth and Environmental (UK) Ltd (2008), Method Statement Zone 4 - Main RRRF Plant, Ref: 7888001173/R3094 (Appendix B.7);
- AMEC Earth and Environmental (UK) Ltd (2008), Validation of Contaminated Land: Phase 1 0 'hotspots', Ref: C34129/R2976 (Appendix B.8);
- AMEC Earth and Environmental (UK) Ltd (2010), Review of Con-Form Report (Con-Form 2010, Validation Report, Final, Ref: C1387/09/01) (Appendix B.9); and
- TerraConsult (2018), Riverside EfW, Ref: 3765R001-2 (Appendix B.10).

1.3.3 This report:

a. considers the proposed activities to be carried out at the site;

b. identifies any land contamination risk the activities pose that may be linked to previous pollution events; and

c. provides a baseline for the existing ground conditions.

1.3.4 This report will present the details on the following:

a. Geology;

b. Hydrogeology;

c. Hydrology and Flooding;

d. Historical and present land use; and

e. Existing ground conditions.

1.3.5 Drawings can be found in Appendix A of the Environmental Permit Application, including but not limited to the following:

- Site location plan;
- Installation Boundary drawing;
- Emission points drawing; and
- Process schematics.

2 Desk Study Information

2.1 Geology, Hydrogeology & Hydrology

Geology

2.1.1 The Envirocheck Report for the REP site indicates that the solid geology within the Installation Boundary is as summarised in Table 2-1 below:

Table 2-1 - Site Geology

Lithology	Description
Artificial Ground	Made ground.
Superficial Deposits	River Terrace Gravel (RTD), comprising sand and gravel, locally with lenses of silt, clay or peat.
Bedrock	Harwich Formation, comprising glauconitic silty or sandy clays, silts and fine-to coarse-grained glauconitic sands, some gravelly, varying to flint gravel beds.

Hydrogeology

2.1.2 The Envirocheck Report for the REP site indicates that the hydrogeology within the Installation Boundary is as follows:

- Soils of High Leaching Potential (U) - Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst-case vulnerability classification (H) is assumed, until proved otherwise.
- Low permeability drift deposits occurring at the surface and overlying Major and Minor Aquifers are head, clay-with-flints, brickearth, peat, river terrace deposits and marine and estuarine alluvium.
- The Installation Boundary is not located within any part of a groundwater source protection zone (SPZ).

2.1.3 It is understood that the EA is currently in the process of updating the groundwater vulnerability maps (to reflect improvements in data mapping and understanding of the factors affecting vulnerability) and these designations should therefore be re-assessed once the new mapping and information is available and this Site Condition report updated accordingly.

2.1.4 It is assumed that groundwater flow across the site will be to the north and northeast, i.e. towards the River Thames.

Hydrology and Surface Waters

2.1.5 The bank of the River Thames forms the northern boundary of the Installation Boundary.

2.1.6 As identified within the Envirocheck Report:

- A drainage ditch runs inside the REP site's eastern boundary before connecting into a series of artificial ponds which form the wetland habitat area.

- Within the Crossness Nature Reserve are three large ponds/clusters of ponds and a longer, larger lagoon which runs NE/SW through the southern half of the nature reserve before connecting to the Great Breach Dyke.

2.2 Pollution History

Historical Land Use within the Installation Boundary

2.2.1 The earliest available Ordnance Survey (OS) mapping dated 1869-1870 shows several buildings labelled as a Manure Works in the northeast of the REP site. These works are indicated to comprise a large building in the north eastern corner of the REP site, with smaller buildings adjacent to the main works, a small terrace of houses to the south of the main works area, and a small building (later labelled the New Marsh Tavern public house) located to the west of the works.

2.2.2 The early maps indicate two piers and cranes are located adjacent to the manure works on the shore of the River Thames. The map indicates the presence of an embankment between the REP site and the River Thames, with sloping masonry on the river side.

2.2.3 The 1894-1895 OS map edition indicates that a Powder Magazine is present adjacent to the western boundary of this site, next to the River Thames.

2.2.4 By 1897, the manure works is no longer labelled on the OS mapping, and the former manure works buildings appear to have been redeveloped. There are three main buildings in the north east of the REP site and it is not clear if these were part of the Belvedere Mills that are indicated to be present adjacent to the eastern boundary (although shown as disused). The Thames Fish, Guano and Oil Works are indicated to have been developed in the north part of the REP site, with New Marsh Tavern between the fish works and the other main buildings. At this time, additional houses have been constructed on the terrace in the south-east part of the REP site and four piers/cranes are shown on the shore of the River Thames.

2.2.5 In the wider area, the 1898/1899 OS map indicates that a sewage works with associated infrastructure such as a gasometer and jetties/piers has been constructed approximately 200m to the west of the REP site. The OS maps indicate the construction may have been placed on an area of raised ground.

2.2.6 The 1909 edition OS map indicates that the three buildings formerly labelled as the disused Belvedere Mills are now in use as a borax refinery. The borax production process involved the refining of borate ores to produce borax, but also generated significant volumes of production wastes which were stored on the land to the south of the REP site, (now the area consented for the Data Centre). In addition, as well as the single long shed sited approximately halfway along the northern boundary of the REP site, just west of the New Marsh Tavern, the Thames Fish, Guano and Oil Works also included two large trenches that (as indicated by an 1871 report by Dr. Ballard, the Medical Health Officer for Islington) were potentially used for storage/maturing of the manure.

2.2.7 A fire insurance plan dated 1908 provides additional detail regarding the specific processes of the businesses operating at the REP site.

2.2.8 The buildings are all located along the northern boundary, accompanied by their own separate wooden jetties for loading/unloading raw/processed materials and goods.

2.2.9 The OS maps indicate that the borax refinery remained largely unchanged during the first half of the 20th Century. Additional houses were added to the terrace in the southeast, and a small

area to the west of the terrace was used as allotment gardens. An issue of The London Gazette dated 9th October 1934 describes the winding-up of the Belvedere Fish Guano Company, following which, in the 1950s the fish, guano and oil works building was redeveloped for use as a depot (the former trenches are no longer shown and are assumed to have been infilled). Historical aerial photography indicates that timber storage took place at the depot across the unbuilt areas during the 1950s.

2.2.10 The 1958 edition OS map indicates that a large depot building has been constructed to the south of the main depot building and the borax refinery (now labelled as a Mill) has been significantly expanded, with several of the earlier sheds being demolished and other sheds being joined together and extended together with the construction of new works buildings. The western side of the REP site is indicated to remain undeveloped. The terrace of housing has been demolished by this time.

2.2.11 In the 1960s a strip of the REP site adjacent to the western boundary is shown on the OS mapping to have been partitioned off. Anecdotal information provided by the Erith and Belvedere Local HistorySociety suggests that this area was used as a car park for employees of a car factory (Ford) on the opposite side of the river, with a ferry service operated by Ford taking workers across the river.

2.2.12 In the wider area, the OS maps indicate that by the late 1960s there has been significant expansion of the sewage works to the west of the REP site. A spoil heap is indicated to be present approximately 50m to the south of the REP site, at the location of the current consented area for the data centre. It is understood (Knight Piesold 2001 & 2003, AMEC 2009, WSP 2016), that this spoil is borax waste from the refinery. This is further described in the planning history section below. To the south of the spoil heap, an electricity substation is indicated to be present, on the southern half of the proposed Norman Road temporary construction laydown area.

2.2.13 By 1974 the OS mapping shows that a new building (understood to be the open-sided storage shed that remained, and was photographed, at the time of the remedial works undertaken by AMEC in 2008) has been constructed immediately to the west of the main depot building. Also at this time the southern 1950s depot shed was demolished.

2.2.14 The 1984 OS map edition indicates that whilst west and south west parts of the REP site appear to remain undeveloped, they have been split into separate land areas. The open land adjacent to the western boundary of the REP site is indicated to be sludge lagoons.

2.2.15 OS mapping dated 1991 shows the northern half of the main depot building to have been demolished. A tank is shown adjacent to the remaining section of building and a new electrical substation has been constructed. Four tanks are also shown to the west of the main ‘Mill’ shed in the north-eastern corner of the REP site. The 1992 and 1996 edition OS maps indicate the presence of individual depots in the separated land areas within the south part of the REP site.

2.2.16 The OS maps indicate that the majority of the buildings in the central, northern and eastern parts of the REP site have been demolished by the mid-late 1990s.

2.2.17 Aerial photography from 1999 and 2003 shows the floor slabs to be still in place, alongside the depot storage shed. The separate strip of land within the western part of the REP site is shown to be in use as a car park.

2.2.18 Aerial photography from 2005 shows the western strip of land to no longer be in use as a car park, following (according to anecdotal information provided by the Erith and Belvedere Local History Society) the withdrawal of the ferry service to the car factory in 2004.

2.2.19 The 2018 OS mapping indicates the current site layout with the existing RRRF having been constructed between 2009 and 2011.

Historical Incidents

2.2.20 The Envirocheck report (Appendix A) records 46 pollution incidents to controlled waters within 1km. The majority of these were classed as Minor Incidents. However, the following were classified as Significant Incidents.

- Approximately 190m west at Dyke-North, Great Breach - Significant Incident (Category 2), dated 1997, spillage of “General”, no receiving water supplied. Ref: THSE1997028954.
- Approximately 470m northwest at Storm Outfall, Crossness Sewage Treatment Works - Significant Incident (Category 2), dated October 1998, spillage of “Storm sewage”, no receiving water supplied. Ref: THSE1998040918.
- Approximately 590m southeast at Tuffnells Parcels - Significant Incident (Category 2), dated 1993, spillage of “Oils –Unknown”, no receiving water supplied. Ref: SE930283.
- Approximately 710m west at Eastern Way, Significant Incident (Category 2), dated December 1994, spillage of “Chemicals - Unknown”, no receiving water supplied. Ref: SE940406.
- Approximately 890m southeast at Anderson Way - Significant Incident (Category 2), dated November 1992, spillage of “Unknown Sewage”, no receiving water supplied. Ref: SE920335.
- Approximately 950m southeast at Crabtree Manorway South - Significant Incident (Category 2), dated January 1997, spillage of “Unknown Sewage”, no receiving water supplied. Ref: THSE1997031808.

2.2.21 Cory are not aware of any pollution incidents having occurred on the land within the Installation Boundary.

Environmental Permits

2.2.22 The Envirocheck report identifies eight active IPPC permits within 1km.

- On-site - Permit Ref: VP3230WG, operated by Riverside Resource Recovery Limited permitting “The incineration of non-hazardous waste in an incineration or co-incineration plant with a capacity exceeding 3 tonnes per hour”.
- On-site - Permit Ref: RP3432UT, operated by Riverside Resource Recovery Limited permitting “Incineration of Non-Hazardous waste greater than 1 T/Hr”
- Approximately 270m west (note: licence is located approx. 700m west at an address stated as the sludge powered generator, however the location used here is not that of the licence but the known location of the generator building) - Permit Ref: UP3737PQ, operated by Thames Water Utilities Limited permitting “The incineration of Non-Hazardous waste greater than 1 T/hr)”.
- Approximately 470m east - Permit Ref: PP/10/50.0, operated by JDT Services Southeast Ltd, permitting “mobile screening and crushing processes”.
- Approximately 710m southeast - Permit Ref: PP/92/13, operated by Henkel Ltd, permitting “coating manufacturing”.
- Approximately 840m southeast - Permit Ref: PP/92/9, operated by Young & Partner, permitting the “manufacture of timber and wood-based products”.

- Approximately 940m southeast - Permit Ref: PP/03/1.0, operated by Lafarge Ready-mix Ltd, permitting the “blending, packing, loading and use of bulk cement”.

- Approximately 940m southeast - Permit Ref: PP/92/3.2, operated by Tarmac Southern Ltd, permitting “mineral drying and roadstone coating processes”.

Groundwater Abstractions

2.2.23 The Envirocheck report does not identify any groundwater abstractions within 1km of the Installation.

Surface Water Abstractions and Discharges

2.2.24 The Envirocheck report records two abstraction permits (surface waters) within 1km as follows:

- On site at “Belvedere Energy Plant”, operated by Cory Environmental Developments Ltd. Licence No. 28/39/44/0028 allowing for abstraction of tidal waters for “Additional Purpose(s) - Cooling Evaporate” at a rate no greater than 173,800,000m^3 per year.

- 220m to the west of the site at the Great Breach Dyke, operated by Thames Water Utilities Ltd. Licence No. 28/39/44/0041 (version 2 of earlier permit) allowing for abstraction of water from a river or stream reach for “Environmental: Non-remedial river/wetland support: Make-up or Top Up water”.

2.2.25 In addition to the surface water abstractions, the Envirocheck report records five active discharge consents to surface water within 1 km of the site as follows:

- On site, ref: CHME.0052, operated by Cory Environmental Developments Ltd, allowing discharge of “Trade Discharge - Cooling Water Authorised by HMIP” to “Freshwater Stream/River”.

- Approximately 400m to the west (Ref Cssa.0362) at Crossness Sewage Treatment Works, operated by Thames Water Utilities Ltd allowing “Sewage Discharges” to “Saline Estuary”.

- Approximately 560m to the east at Lidl UK GMBH Distribution Warehouse, DA17 6BS, ref: Casm.0331, operated by Lidl UK GMBH, allowing discharge of “Trade Effluent Discharge - Site Drainage” to “Saline Estuary”.

- Approximately 810m to the southeast at a Thames Water pumping station on Crabtree Manorway, Ref: Temp.0770, operated by Thames Water Utilities Ltd. allowing discharge of “Freshwater Stream/River” to the River Thames.

- Approximately 910m to the northwest at Crossness Sewage Treatment Works, Ref: Cssa.0362, operated by Thames Water Utilities Ltd, allowing discharge of “Sewage Discharges STW Storm Overflow/Storm Tank - Water Company” into “Saline Estuary”.

- Approximately 910m to the southeast at Crabtree Manorway North, Ref: T00382, operated by Henkel Chemicals Ltd., allowing discharge of “Freshwater Stream/River” into the Green Level dyke.

Landfill Sites

2.2.26 The Envirocheck report indicates that there are three landfill sites within 1km of the site, as follows:

- Approximately 700m to the north-east, Ford Motor Company Limited, Ex-City of London Site - inert, commercial and household waste landfill. Last waste received December 1988.

- Approximately 770m to the north, ARC Aggregates, Dagenham Dock - industrial and special waste landfill. Last waste received October 1990.

- Approximately 860m to the north-east, Manor Way – waste type not specified. Last waste received not specified.

2.2.27 It should be noted that these landfills are all located on the north side of the River Thames, therefore they are not anticipated to impact on the ground conditions within the Installation Boundary.

3 Previous Contamination and Site Investigations

3.1.1 EA guidance note titled '*H5: Site Condition Report – Guidance and Templates*', states "*where a facility involves the use, production or release of RHS*" a baseline report must be submitted as part of the application Site Condition Report.

3.1.2 At the time of submitting this application, the following site investigations have been undertaken on land which is within the site boundary. It is noted that some of these reports were submitted to the EA in support of the EP application for the adjacent RRRF.

- Wilkinson Associates (1992), Report on Site Investigation at Waste to Energy Incineration Plant, Belvedere;
- Wilkinson Associates (1992), Report on Site Investigation at Chitty Site, Waste to Energy Incineration Plant, Belvedere;
- Wilkinson Associates (1992), Report on Site Investigation at Greenham Site, Waste to Energy Incineration Plant, Belvedere;
- Applied Environmental Research Centre Ltd (2003), Site Investigation and Remediation Proposals, Ref: C3477/R1384;
- Soil Mechanics Ltd (2007), Factual Report on Ground Investigation, Ref: G7061;
- Applied Environmental Research Centre Ltd (2003), Site Investigation and Remediation Proposals, Ref: C3477/R1384;
- AMEC Earth and Environmental (UK) Ltd (2008), Method Statement Zone 4 - Main RRRF Plant, Ref: 7888001173/R3094;
- AMEC Earth and Environmental (UK) Ltd (2008), Validation of Contaminated Land: Phase 1 0 'hotspots', Ref: C34129/R2976;
- AMEC Earth and Environmental (UK) Ltd (2010), Review of Con-Form Report (Con-Form 2010, Validation Report, Final, Ref: C1387/09/01); and
- TerraConsult (2018), Riverside EfW, Ref: 3765R001-2.

3.2 Site Investigations

Wilkinson Associates (1992), Report on Site Investigation at Waste to Energy Incineration Plant, Belvedere

3.2.1 Field work was carried out between 17th August and 5th September 1992 and consisted of 6 boreholes, 6 Cone Penetration tests (CPT) with inspection pits and 4 trial pits. In situ tests were performed and samples were taken from boreholes and pits for geotechnical contamination testing.

3.2.2 All pits were backfilled with arisings immediately after excavation, logging and sampling. Boreholes were grouted, and piezometers were installed.

3.2.3 For the purposes of establishing the baseline conditions for the site, none of the boreholes or trial pits were located within the proposed Installation Boundary; however, they were located within the boundary of the adjacent RRRF. Therefore, the data recorded is considered to be representative of the ground conditions within the Installation Boundary for REP.

Wilkinson Associates (1992), Report on Site Investigation at Chitty Site, Waste to Energy Incineration Plant, Belvedere

3.2.4 Field work was carried out on 8th December 1992 and consisted of 6 Drive in Sampler (DIS) probing to a maximum depth of 2.5m. Representative disturbed solid samples were taken from the window in the extracted sampler. All DIS holes were backfilled with arisings immediately after completion and the surfaces were reinstated with concrete.

3.2.5 Contamination testing was performed at a specialist laboratory on 5 solid samples.

3.2.6 For the purposes of establishing the baseline conditions for the site, none of the DIS probings were located within the proposed Installation Boundary; however, they were located within the boundary of the adjacent RRRF. Therefore, the data recorded is considered to be representative of the ground conditions within the Installation Boundary for REP.

Wilkinson Associates (1992), Report on Site Investigation at Greenham Site, Waste to Energy Incineration Plant, Belvedere

3.2.7 Field work was carried out on 12th November 1992 and consisted of 8 trial pits excavated by machine to a maximum depth of 1.5m. Representative disturbed solid samples were taken from each trial pit. Two groundwater samples were also obtained. All trial pits were backfilled with arisings immediately after excavation and sampling.

3.2.8 Contamination testing was performed at a specialist laboratory on 18 solid samples and 2 water samples.

3.2.9 For the purposes of establishing the baseline conditions for the site, trial pits 1 and F are not applicable as they lie outside of the site boundary.

Applied Environmental Research Centre Ltd (2003), Site Investigation and Remediation Proposals, Ref: C3477/R2489

3.2.10 Applied Environmental Research Centre (AERC) has carried out two site investigations in July-September 2003 and August 2006. A total of 53 exploratory holes and 10 boreholes were excavated and a selected number of solid and liquid samples were analysed for a range of determinants. The analytical suite for both solids and liquids were selected on the basis of the site history and included potentially zootoxic and phytotoxic elements, together with inorganic and organic substances. Leaching tests were also carried out on a selected number of samples.

3.2.11 For the purposes of establishing the baseline conditions for the site, only trial pits 13, 23, 24,25, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38 and boreholes 4, 7, 8, 9 and 10 are applicable.

3.2.12 This report also included summary analytical results from a 1989 Site Investigation by Terresearch, and a Contamination Risk Assessment Survey by Knight Piesold in 2000.

Soil Mechanics Ltd (2007), Factual Report on Ground Investigation, Ref: G7061

3.2.13 In June 2007, Soil Mechanics carried out a ground investigation to obtain geotechnical and environmental information for the site. The scope of the investigation comprised cable percussion boreholes, trial pits, in situ testing and laboratory testing. The fieldwork was carried out between June and October 2007 and 25 trial pits and 27 boreholes were excavated.

3.2.14 Disturbed samples were recovered during cable tool drilling and environmental samples were also taken.

Applied Environmental Research Centre Ltd (2003), Site Investigation and Remediation Proposals, Ref: C3477/R1384

3.2.15 The field work was carried out between 23 July 2003 and 15 September 2003 and involved the excavation of trial holes, installation of boreholes, sampling of solids and waters, and a water level survey. A total of 50 trial pits were excavated across the site, ranging in depth from 1.6m to 3.0m.

3.2.16 10 boreholes were sunk by cable percussion techniques in the period between 31 July and 15 August 2003 on the ‘main development site’. Groundwater monitoring standpipes were placed in all boreholes and groundwater samples were collected on two occasions.

3.2.17 Disturbed solid samples from all exploratory holes were collected at depths throughout the profile. All samples were dispatched to Applied Environmental Services laboratories for examination and testing.

AMEC Earth and Environmental (UK) Ltd (2008), Validation of Contaminated Land: Phase 1 0 'hotspots', Ref: C34129/R2976

3.2.18 A total of 14 "hotspots" had been identified as requiring remediation where Total Polyaromatic Hydrocarbons is present at concentrations in excess of 1,000mg/kg^{-1}.

3.2.19 Excavated material from each "hotspot" was transported by dumper truck and stockpiled within the open-sided steel framed building located in the north western sector of the "main development site". The excavated material has been screened to remove concrete slabs, brick fragments and other material prior to either (a) disposal off-site, or (b) bioremediation and re-use on-site.

3.2.20 Validation samples were collected from the base and sidewalls of the excavations and were forwarded to Applied Environmental Services’ laboratory for testing. Validation samples were analysed for speciated TPH and the results were compared with the trigger threshold value of 500mg.kg-1.

AMEC Earth and Environmental (UK) Ltd (2010), Review of Con-Form Report (Con-Form 2010, Validation Report, Final, Ref: C1387/09/01)

3.2.21 CON-FORM was commissioned by Costain Ltd to undertake the treatment of contaminated soils in the remediation of the Riverside Resource Recycling Facility (RRRF).

3.2.22 Their strategy was principally associated with the screening, processing and lime treatment of stockpiled soil volumes and validation testing of these soils (against a remediation specification) for potential site reuse. Soils for treatment were identified and designated via a bulk dig by Costain Ltd.

3.2.23 Approximately 20,500 m^3 of materials were ex-situ process treated by CON-FORM. Costain undertook the overturning of ground and bulk excavation across the Phase 1 area and enabled targeted excavations to minimise stockpiling. Con-Form patent batch process stabilisation technology was considered the most suitable methodology given the significant presence of fines with coarse materials in the soil. The process involved the process of 1) screening to meet backfill requirements in the recovery of aggregate materials 2) addition of quick lime in the drying and treatment of the fine materials.

TerraConsult (2018), Riverside EfW, Ref: 3765R001-2.

3.2.24 TerraConsult was commissioned by Hitachi Zosen Inova AG (HZI) to carry out a ground investigation for the proposed energy from waste facility at the Cory Riverside Facility, Belvedere, London.

3.2.25 The scope of the investigation, which was specified by GDG, comprised:

- boreholes formed by cable percussion (13) and rotary (2) techniques;
- mechanically excavated trial pits (6);
- in situ testing comprising of;
    - standard penetration tests in boreholes;
    - PID;
    - variable head permeability testing;
- post fieldwork monitoring and sampling;
- geotechnical laboratory testing;
- geo-environmental laboratory testing; and
- Factual report (GIR) and Association of Geotechnical and Geo-environmental Specialists (AGS) data.

3.2.26 The fieldwork was carried out between 27 March 2018 and 03 May 18; and 11 to 16 June 18.

3.3 Soil Contamination Monitoring & Results

3.3.1 A summary of the pollutant concentrations reported within the site investigation reports, as referenced in paragraphs 3.2.1 to 3.2.26, are presented in Table 3-1 to Table 3-4. The information presented in the individual tables is as follows:

- Table 3-1 – soil samples taken prior to remediation and development of RRRF (i.e. excluding the site investigation reports referenced in paragraphs 3.2.1 to 3.2.17);
- Table 3-2 – Results from the Phase 1 ‘hotspot’ validation and remediation report (taken from site investigation reports paragraphs 3.2.18 to 3.2.20)
- Table 3-3 – Summaries of untreated soil results from the 2010 Validation Report (taken from site investigation reports referenced in paragraphs 3.2.21 to 3.2.23);
- Table 3-4 – Summaries of treated soil results from the 2010 Validation Report (taken from site investigation reports referenced in paragraphs 3.2.21 to 3.2.23); and
- Table 3-5 – Summary of soil analysis from the 2018 Site Investigations (taken from site investigation reports referenced in paragraph 3.2.24 to 3.2.26). These are considered to be representative of the condition of soils at the time of submission of the EP application.

Table 3-1 - Soil Concentrations Prior to Development of RRRF

Pollutant	Min Value (mg/kg) unless stated	Max Value (mg/kg) unless stated
pH (no units)	5	12.2
Arsenic	<5	5600
Arsenic (µg/l)	17	1484
Cadmium	<0.07	17
Cadmium (µg/l)	0.1	5.5
Chromium	<0.1	63
Chromium (µg/l)	6	63
Chromium VI	<0.1	0.2
Copper	<2.9	1860
Copper (µg/l)	7	625
Lead	5	7400
Lead (µg/l)	9	2175
Mercury	<0.1	18
Mercury (µg/l)	<0.01	18
Nickel	2	366
Nickel (µg/l)	7	366
Selenium	<0.5	1.7
Zinc	10	8500
Zinc (µg/l)	22	2750
Water-Soluble Boron	1.6	160000
Water-Soluble Boron (µg/l)	4	96
Sulphate	100	340000
Total Sulphate (%)	0.01	34
Water-Soluble Sulphate (g/l)	0.08	12.8

Water-Soluble Sulphate 1:2 (g/l)	0.15	12.8
Water-Soluble Sulphate 2:1 (g/l)	0.02	3.7
Sulphide	<10	2000
Sulphide (µg/l)	1	503
Total Sulphide (%)	<0.01	0.2
Chloride	100	2556
Total Chloride (%)	<0.01	0.09
Toluene Extractable Material	100	20500
Toluene Extractable Material (%)	<0.05	1.4
Phenols	<0.5	5.4
Phenols (µg/l)	<0.5	-
Cyanide	0.1	2.4
Fraction Organic Carbon (% M/M)	1.01	5.18
Organic Matter (%)	0.5	33
Asbestos (%)	<2	2
TPH (Total Petroleum Hydrocarbons) (µg/l)	29	2193
TPH by GCFID (AR)	58	1230
Benzene	<0.002	<0.5
Benzene (µg/l)	<0.002	0.011
Benzo(a)pyrene (µg/l)	<0.3	13
Toluene	<0.002	<0.5
Toluene (µg/l)	<0.002	0.028
Xylenes	<0.002	<0.024
Xylenes (µg/l)	<0.002	0.004

Ethyl Benzene	<0.002	<0.012
Ethyl Benzene (µg/l)	<0.002	0.004
Chlorinated Hydrocarbons		
1,1,1-Trichloroethane	<0.0006	<0.5
1,2-Dichloroethane	<0.015	<0.5
Tetrachloroethene	<0.0006	<2.5
Tetrachloroethene (µg/l)	<0.006	-
Tetrachloromethane	<0.0003	-
Trichloroethene	<0.0015	<0.5
Trichloroethene (µg/l)	<0.0015	0.01
Trichloroethane	<0.003	0.004
Trichloroethane (µg/l)	<0.006	-
PAH (Polycyclic Aromatic Hydrocarbons)	1	145
PAH (µg/l)	1	145
Polycyclic Aromatic Hydrocarbons		
Naphthalene	<0.08	1678.93
Acenaphthylene	<0.08	67.68
Acenaphthene	<0.08	303.92
Fluorene	<0.08	375.84
Phenanthrene	<0.08	1336.21
Anthracene	<0.08	299.04
Fluoranthene	<0.08	652.02
Pyrene	<0.08	795.29
Benzo(a)anthracene	<0.08	368.96
Chrysene	<0.08	603.32
Benzo(b)fluoranthene	<0.08	249.88
Benzo(k)fluoranthene	<0.08	88.95

Benzo(a)pyrene	<0.08	513
Indeno(1,2,3 cd)pyrene	<0.08	130.55
Dibenzo(a,h)anthracene	<0.08	27.17
Benzo(g,h,i)perylene	<0.08	108.82
Total PAH	5	145
Coronene	<0.08	54.2
Total (USEPA16) PAHs (< than)	1.28	6727.74
Aliphatics/Aromatics		
>C8-C10 Aliphatics (wet weight)	<4	469
>C8-C10 Aromatics (wet weight)	<4	387
>C10-C12 Aliphatics (wet weight)	<4	1510
>C10-C12 Aromatics (wet weight)	<4	2170
>C12-C16 Aliphatics (wet weight)	<4	4840
>C12-C16 Aromatics (wet weight)	<4	11100
>C16-C21 Aliphatics (wet weight)	<4	7440
>C16-C21 Aromatics (wet weight)	<4	15900
>C21-C35 Aliphatics (wet weight)	<8.76	18600
>C21-C35 Aromatics (wet weight)	<8.76	36300
>C8-C10 Aliphatics (dry weight)	<5	<9
>C8-C10 Aromatics	<4	<7
>C10-C12 Aliphatics	<4	<7

>C10-C12 Aromatics	<5	22.2
>C12-C16 Aliphatics	<5	6.91
>C12-C16 Aromatics	<5	40
>C16-C21 Aliphatics	<5	39.9
>C16-C21 Aromatics	<5	260
>C21-C35 Aliphatics	<9.92	192
>C21-C35 Aromatics	<9.92	1010
Polychlorinated Biphenyls (congeners)		
PCB28	<0.0049	<0.005
PCB52	<0.0049	<0.005
PCB101	<0.005	0.0125
PCB118	<0.005	0.009
PCB153	<0.005	0.0124
PCB138	<0.005	0.0155
PCB180	<0.0049	0.006
Organotins		
Dibutyl Tin	<10	<12
Tributyl Tin	<10	<12
Tetrabutyl Tin	<10	<12
Triphenyl Tin	<10	<12
Semi-Volatile Organic Compounds		
Phenol	<100	-
bis(2-Chloroethyl)ether	<25	-
2-Chlorophenol	<100	-
1,3-Dichlorobenzene	<25	-
1,4-Dichlorobenzene	<25	-
Benzyl alcohol	<25	-

1,2-Dichlorobenzene	<25	-
2-Methylphenol	<25	-
bis(2-Chloroisopropyl)ether	<25	-
Hexachloroethane	<25	-
N-Nitroso-di-n-propylamine	<25	-
3- & 4-Methylphenol	<100	-
Nitrobenzene	<25	-
Isophorone	<25	-
2-Nitrophenol	<100	-
2,4-Dimethylphenol	<100	-
Benzoic Acid	<500	-
bis(2-Chloroethoxy)methane	<25	-
2,4-Dichlorophenol	<100	-
1,2,4-Trichlorobenzene	122.834	183.3
4-Chlorophenol	<100	-
4-Chloroaniline	<25	-
Hexachlorobutadiene	<25	-
4-Chloro-3-methylphenol	<25	-
2-Methylnaphthalene	<10	-
1-Methylnaphthalene	<10	-
Hexachlorocyclopentadiene	<25	-
2,4,6-Trichlorophenol	<100	-
2,4,5-Trichlorophenol	<100	-
2-Chloronaphthalene	<10	-
Biphenyl	<10	-
Diphenyl ether	<10	-
2-Nitroaniline	<25	-

Dimethylphthalate	<25	-
2,6-Dinitrotoluene	<25	-
3-Nitroaniline	<25	-
2,4-Dinitrophenol	<50	-
Dibenzofuran	<25	-
4-Nitrophenol	<250	-
2,4-Dinitrotoluene	<25	-
Diethylphthalate	<25	-
4-Chlorophenyl-phenylether	<25	-
4,6-Dinitro-2-methylphenol	<250	-
4-Nitroaniline	<25	-
N-Nitrosodiphenylamine	<25	-
4-Bromophenyl-phenylether	<25	-
Hexachlorobenzene	<25	-
Pentachlorophenol	<250	-
Di-n-butylphthalate	<25	-
Butylbenzylphthalate	<25	-
3,3'-Dichlorobenzidine	<100	-
bis(2-Ethylhexyl)phthalate	<25	-
Di-n-octylphthalate	<10	-
Volatile Organic Compounds		
Dichlorodifluoromethane	<0.5	-
Chloromethane	<0.5	-
Vinyl Chloride	<0.5	-
Bromomethane	<2.5	-
Chloroethane	<2.5	-
Trichlorofluoromethane	<0.5	-

1,1-Dichloroethene	<0.5	-
trans 1,2-Dichloroethene	<0.5	-
1,1-Dichloroethane	<0.5	-
2,2-Dichloropropane	<0.5	-
cis 1,2-Dichloroethene	<0.5	-
Bromochloromethane	<0.5	-
Chloroform	<0.5	-
Carbon Tetrachloride	<0.5	-
1,1-Dichloropropene	<0.5	-
1,2-Dichloropropane	<0.5	-
Dibromomethane	<0.5	-
Bromodichloromethane	<0.5	-
cis 1,3-Dichloropropene	<0.5	-
trans 1,3-Dichloropropene	<0.5	-
1,1,2-Trichloroethane	<0.5	-
1,3-Dichloropropane	<0.5	-
Dibromochloromethane	<0.5	-
1,2-Dibromoethane	<0.5	-
Chlorobenzene	<0.5	-
Ethylbenzene	<0.5	-
1,1,1,2-Tetrachloroethane	<0.5	-
m and p-Xylene	<0.5	-
o-Xylene	<0.5	-
Styrene	<0.5	-
Bromoform	<0.5	-
iso-Propylbenzene	<0.5	-
Propylbenzene	<0.5	-

Bromobenzene	<0.5	-
1,2,3-Trichloropropane	<0.5	-
2-Chlorotoluene	<0.5	-
1,3,5-Trimethylbenzene	<0.5	-
4-Chlorotoluene	<0.5	-
tert-Butylbenzene	<0.5	-
1,2,4-Trimethylbenzene	<0.5	-
sec-Butylbenzene	<0.5	-
p-Isopropyltoluene	<0.5	-
n-Butylbenzene	<0.5	-
1,2-Dibromo-3-chloropropane	<2.5	-
1,2,3-Trichlorobenzene	28.533	-
Tentatively Identified Compounds		
1,7-Dimethylnaphthalene	1.752	-
1,2,4,5-tetrachlorobenzene	1.654	-

Table 3-2 - Soil Concentrations at 'Hotspots' from Validation Report 2008

Pollutant	Min Value (mg/kg) unless stated	Max Value (mg/kg) unless stated
TPH (>C10-C12)	<5	4330
TPH (>C12-C16)	<5	15250
TPH (>C16-C21)	<5	7434
TPH (>C21-C40)	<5	124012
Total Petroleum Hydrocarbons	<20	139465
pH	9.1	9.6
Arsenic	14	30
Chromium	21	27

Cadmium	0.21	0.26
Mercury	0.42	0.55
Copper	44	63
Nickel	16	21
Lead	109	136
Zinc	111	135
Selenium	0.13	0.22
Phenols	<0.5	0
Cyanide	<1	1
Water Soluble Sulphate SO4 (g/l)	0.06	0.81
Sulphide	1	3
Naphthalene	<0.3	0
Acenaphthylene	<0.3	0
Acenaphthene	1	3.6
Fluorene	<0.3	1.5
Phenanthrene	<0.3	1
Anthracene	<0.3	1.3
Fluoranthene	1.8	2.3
Pyrene	0.5	1.9
Benzo(a)anthracene	<0.3	0.5
Chrysene	<0.3	0.8
Benzo(b)fluoranthene	<0.3	0.7
Benzo(k)fluoranthene	<0.3	0.4
Benzo(a)pyrene	<0.3	0
Indeno(1,2,3cd)pyrene	<0.3	0
Dibenzo(a,h)anthracene	<0.3	0
Benzo(g,h,i)perylene	<0.3	0

Total PAH	5.3	11
Leachate Tests:		
Arsenic	0.26	64.6
Arsenic (µg/l)	26	6436
Antimony	<0.07	-
Antimony (µg/l)	<7	-
Barium	<0.1	1.4
Barium (µg/l)	<0.01	0.14
Cadmium	<0.01	0.32
Cadmium (µg/l)	<1	32
Chromium	<0.07	0.76
Chromium (µg/l)	<7	76
Mercury	<0.0002	<0.002
Mercury (µg/l)	<0.2	0.24
Selenium	<0.13	-
Selenium (µg/l)	<13	-
Copper	<0.07	0.61
Copper (µg/l)	<7	61
Nickel	<0.07	0.58
Nickel (µg/l)	<7	58
Lead	<0.07	0.1
Lead (µg/l)	<7	10
Zinc	<0.07	1.6
Zinc (µg/l)	<7	163
Molybdenum	<0.1	1.8
Molybdenum (mg/l)	<0.01	0.18
Sulphate SO4	420	15180

Sulphate SO4 (mg/l)	42	1518
Chloride Cl-	<10	91
Chloride Cl- (mg/l)	<1	9.1
Fluoride F-	<10	330
Fluoride F- (mg/l)	<1	16
DOC	40	400
DOC (mg/l)	4	40
Total Dissolved Solids	119	90940
Total Dissolved Solids (mg/l)	12	9094
Total Organic Matter (%)	0.73	25.13

Table 3-3 - Untreated Soil Concentrations Pre-Remediation from Validation Report 2010

Pollutant	Min Value (mg/kg) unless stated	Max Value (mg/kg) unless stated
pH	8.5	9.4
Antimony	3.2	1.7
Cyanide Complex	<2.5	-
Alkalinity (mg/l)	<10	12
Total Sulphate as SO4 (%)	1.37	1.71
Water Soluble Chloride (%)	0.01	-
Water Soluble Sulphate (g/l)	0.01	2.1
Total Organic Carbon (%)	3.12	3.31
Cadmium	<1	17
Chromium	19	59
Copper	21	6500
Lead	57	2900
Mercury	<0.5	9.4

Nickel	18	110
Selenium	<0.5	0
Zinc	190	4700
Water Soluble Boron	27	550
Arsenic	30	7400
Sulphide	<10	790
Water Soluble Sulphate	0.51	5.6
Total Phenols	<0.5	1.8
Total PAHs	<0.1	120
TPH (C10-C40)	<10	910

Table 3-4 – Treated Soil Concentrations Post-Remediation from Validation Report 2010

Pollutant	Min Value (mg/kg) unless stated	Max Value (mg/kg) unless stated
pH (no units)	10.2	12.6
Organic Matter (%)	3.1	4.1
Organic Carbon (%)	1.4	2.4
Dissolved Organic Carbon	<500	-
Total Dissolved Solids	3110	20600
Arsenic	<0.5	100
Boron (Water Soluble)	63	130
Cadmium	<0.04	4.5
Chromium	<0.5	31
Copper	<2	190
Mercury	<0.01	1.1
Nickel	<0.4	24
Lead	<0.5	340
Selenium	<0.1	<0.5

Zinc	<4	370
Barium	<20	-
Antimony	<0.06	-
Molybdenum	<0.5	-
Phenol	<1	-
Total Sulphate as SO4	<1000	2800
Total Sulphate as SO4 (%)	1.06	-
Water Soluble Sulphate (g/l)	0.6	-
Potential Sulphate (%)	1.46	-
Oxidisable Sulphide (%)	0.01	-
Fluoride	<10	12
Chloride	<800	-
PAH	<10	-
Mineral Oils	<10	350
PCB	<1	<10
Benzene	<1	-
Toluene	<1	-
Ethylbenzene	<1	-
Xylene	<1	-

Table 3-5 - Summary of soil analysis from the 2018 Site Investigations

Pollutant	Min Value (mg/kg) unless stated	Max Value (mg/kg) unless stated
General Inorganics		
pH (no units)	7.6	11.6
Total Cyanide	<1	-
Water Soluble Sulphate as SO4-16hr extraction (2:1)	27	4600

Water Soluble SO4 (16hr extraction) (2:1 Leachate Equivalent) (g/l)	0.0136	2.3
Organic Matter (%)	0.1	6.8
Speciated PAH's		
Naphthalene	<0.05	0.9
Acenaphthylene	<0.05	0.3
Acenaphthene	<0.05	4.1
Fluorene	<0.05	2.7
Phenanthrene	<0.05	30
Anthracene	<0.05	3.4
Fluoranthene	<0.05	26
Pyrene	<0.05	18
Benzo(a)anthracene	<0.05	5.7
Chrysene	<0.05	4.6
Benzo(b)fluoranthene	<0.05	7
Benzo(k)fluoranthene	<0.05	1.8
Benzo(a)pyrene	<0.05	5.7
Indeno(1,2,3-cd)pyrene	<0.05	2.7
Dibenz(a,h)anthracene	<0.05	0.63
Benzo(ghi)perylene	<0.05	3.1
Total Speciated PAH's	<0.8	99.9
Heavy Metals/Metalloids		
Arsenic	7.9	630
Boron (water soluble)	1.4	4700
Cadmium	<0.2	1.2
Chromium	<4	37
Copper	9.4	53
Lead	7.1	730

Mercury	<0.3	2100
Nickel	<0.3	26
Selenium	<1	45
Vanadium	<1	84
Zinc	14	3400
Monoaromatics		
Benzene (µg/kg)	<1	-
Toluene (µg/kg)	<1	-
Ethylbenzene (µg/kg)	<1	-
p & m-xylene (µg/kg)	<1	-
o-xylene (µg/kg)	<1	-
MTBE (Methyl Tertiary Butyl Ether) (µg/kg)	<1	-
Petroleum Hydrocarbons		
TPH (C10-C40)	<10	2300
TPH-CWG Aliphatic >EC5-EC6	<0.001	0.001
TPH-CWG Aliphatic >EC6-EC8	<0.001	0.001
TPH-CWG Aliphatic >EC8-EC10	<0.001	0.001
TPH-CWG Aliphatic >EC10-EC12	<1	2.4
TPH-CWG Aliphatic >EC12-EC16	<2	310
TPH-CWG Aliphatic >EC16-EC21	<8	820
TPH-CWG Aliphatic >EC21-EC35	<8	490
TPH-CWG Aliphatic >EC35-EC44	<8.4	920
TPH-CWG Aliphatic (EC5-EC35)	<10	1600
TPH-CWG Aliphatic (EC5-EC44)	<10	1800
TPH-CWG Aromatic >EC5-EC7	<0.001	0.001

TPH-CWG Aromatic >EC7-EC8	<0.001	0.001
TPH-CWG Aromatic >EC8 - EC10	<0.001	0.001
TPH-CWG Aromatic >EC10 - EC12	<1	10
TPH-CWG Aromatic >EC12 - EC16	<2	78
TPH-CWG Aromatic >EC16 - EC21	<10	200
TPH-CWG Aromatic >EC21 - EC35	<10	760
TPH-CWG Aromatic > EC35 - EC44	<8.4	2700
TPH-CWG Aromatic (EC5 - EC35)	<10	800
TPH-CWG Aromatic (EC5 - EC44)	<10	3500
VOC's		
Chloromethane (µg/kg)	<1	-
Chloroethane (µg/kg)	<1	-
Bromomethane (µg/kg)	<1	-
Vinyl Chloride (µg/kg)	<1	-
Trichlorofluoromethane (µg/kg)	<1	-
1,1-Dichloroethene (µg/kg)	<1	-
1,1,2-Trichloro 1,2,2-Trifluoroethane (µg/kg)	<1	-
Cis-1,2-dichloroethene (µg/kg)	<1	-
MTBE (µg/kg)	<1	-
1,1-Dichloroethane (µg/kg)	<1	-
2,2-Dichloropropane (µg/kg)	<1	-
Trichloromethane (µg/kg)	<1	-
1,1,1-Trichloroethane (µg/kg)	<1	-
1,2-Dichloroethane (µg/kg)	<1	-

1,1-Dichloropropene (µg/kg)	<1	-
Trans-1,2-dichloroethene (µg/kg)	<1	-
Benzene (µg/kg)	<1	-
Tetrachloromethane (µg/kg)	<1	-
1,2-Dichloropropane (µg/kg)	<1	-
Trichloroethene (µg/kg)	<1	-
Dibromomethane (µg/kg)	<1	-
Bromodichloromethane (µg/kg)	<1	-
Cis-1,3-dichloropropene (µg/kg)	<1	-
Trans-1,3-dichloropropene (µg/kg)	<1	-
Toluene (µg/kg)	<1	-
1,1,2-Trichloroethane (µg/kg)	<1	-
1,3-Dichloropropane (µg/kg)	<1	-
Dibromochloromethane (µg/kg)	<1	-
Tetrachloroethene (µg/kg)	<1	-
1,2-Dibromoethane (µg/kg)	<1	-
Chlorobenzene (µg/kg)	<1	-
1,1,1,2-Tetrachloroethane (µg/kg)	<1	-
Ethylbenzene (µg/kg)	<1	-
p & m-xylene (µg/kg)	<1	-
Styrene (µg/kg)	<1	-
Tribromomethane (µg/kg)	<1	-
o-Xylene (µg/kg)	<1	-
1,1,2,2-Tetrachloroethane (µg/kg)	<1	-
Isopropylbenzene (µg/kg)	<1	-

Bromobenzene (µg/kg)	<1	-
n-Propylbenzene (µg/kg)	<1	-
2-Chlorotoluene (µg/kg)	<1	-
4-Chlorotoluene (µg/kg)	<1	-
1,3,5-Trimethylbenzene (µg/kg)	<1	-
tert-Butylbenzene (µg/kg)	<1	-
1,2,4-Trimethylbenzene (µg/kg)	<1	-
sec-Butylbenzene (µg/kg)	<1	-
1,3-Dichlorobenzene (µg/kg)	<1	-
p-Isopropyltoluene (µg/kg)	<1	-
1,2-Dichlorobenzene (µg/kg)	<1	-
1,4-Dichlorobenzene (µg/kg)	<1	-
Butylbenzene (µg/kg)	<1	-
1,2-Dibromo-3-chloropropane (µg/kg)	<1	-
1,2,4-Trichlorobenzene (µg/kg)	<1	-
Hexachlorobutadiene (µg/kg)	<1	-
1,2,3-Trichlorobenzene (µg/kg)	<1	-
1,2,3-Trichloropropane (µg/kg)	<1	-
1,3,5-Trichlorobenzene (µg/kg)	<1	-
Carbon Disulphide (µg/kg)	<1	-
Dichlorodifluoromethane (µg/kg)	<1	-
Dichloromethane (µg/kg)	<100	-
1,2,3,4-Tetrachlorobenzene (µg/kg)	<1	-
1,2,3,5-Tetrachlorobenzene (µg/kg)	<1	-
1,2,4,5-Tetrachlorobenzene (µg/kg)	<1	-

Pentachlorobenzene (µg/kg)	<1	-
Diisopropyle ether (DIPE)	<0.1	-
Ethyl-t-butyl ether (ETBE)	<0.1	-
Methyl-t-butyl ether (MTBE)	<0.1	-
t-amyl ethyl ether (TAEE)	<0.1	-
t-amyl methyl ether (TAME)	<0.1	-
t-butylalcohol (TBA)	<0.1	-
SVOC's		
Aniline	<0.1	-
Phenol	<0.2	-
2-Chlorophenol	<0.1	-
Bis(2-chloroethyl)ether	<0.2	-
1,3-Dichlorobenzene	<0.2	-
1,2-Dichlorobenzene	<0.1	-
1,4-Dichlorobenzene	<0.2	-
Bis(2-chloroisopropyl)ether	<0.1	-
2-Methylphenol	<0.3	-
Hexachloroethane	<0.05	-
Nitrobenzene	<0.3	-
4-Methylphenol	<0.2	-
Isophorone	<0.2	-
2-Nitrophenol	<0.3	-
2,4-Dimethylphenol	<0.3	-
Bis(2-chloroethoxy)methane	<0.3	-
1,2,4-Trichlorobenzene	<0.3	-
Naphthalene	<0.05	0.36
2,4-Dichlorophenol	<0.3	-

4-Chloroaniline	<0.1	-
Hexachlorobutadiene	<0.1	-
4-Chloro-3-methylphenol	<0.1	-
2,4,6-Trichlorophenol	<0.1	-
2,4,5-Trichlorophenol	<0.2	-
2-Methylnaphthalene	<0.1	1.1
2-Chloronaphthalene	<0.1	-
Dimethylphthalate	<0.1	-
2,6-Dinitrotoluene	<0.1	-
Acenaphthylene	<0.05	0.27
Acenaphthene	<0.05	4.1
2,4-Dinitrotoluene	<0.2	-
Dibenzofuran	<0.2	2.1
4-Chlorophenylether	<0.3	-
Diethyl phthalate	<0.2	-
4-Nitroaniline	<0.2	-
Fluorene	<0.05	2.7
Azobenzene	<0.3	-
Bromophenylether	<0.2	-
Hexachlorobenzene	<0.3	-
Phenanthrene	<0.05	11
Anthracene	<0.05	3
Carbazole	<0.3	0.7
Dibutyl phthalate	<0.2	-
Anthraquinone	<0.3	-
Fluoranthene	<0.05	8.6
Pyrene	<0.05	7.7
Butylbenzylphthalate	<0.3	2.8

Benzo(a)anthracene		
Chrysene	<0.05	4.4
Benzo(b)fluoranthene	<0.05	3.8
Benzo(k)fluoranthene	<0.05	7
Benzo(a)pyrene	<0.05	1.8
Indeno(1,2,3-cd)pyrene	<0.05	4.8
Dibenz(a,h)anthracene	<0.05	2.7
Benzo(ghi)perylene	<0.05	0.63
Chlorophenols		
Pentachlorophenol (PCP)	<0.1	-

3.4 Groundwater and Surface Water Monitoring & Results

3.4.1 Analytical results for ground water and surface water samples are presented in the report referenced in paragraph to 3.2.21 to 3.2.23. These are considered to be representative of the condition of groundwater and surface water at the time of submission of the EP application. A summary of reported pollutant concentrations in the groundwater prior to development of REP is presented in Table 3-6.

Table 3-6 – Water Concentrations Prior to Development of REP

Pollutant	Min Value (mg/l) unless stated	Max Value (mg/l) unless stated
General Inorganics		
Total Cyanide (µg/l)	<10	-
pH (no units)	6.8	8
Sulphate as SO4 (µg/l)	3440	980000
Sulphate as SO4	3.4	980
Chloride	48	5500
Total Phosphate as P (µg/l)	<20	1500
Fluoride (µg/l)	220	4500
Ammoniacal Nitrogen as N (µg/l)	24	25000
Dissolved Organic Carbon (DOC)	3.53	178
Nitrate as N	0.02	6.28

Nitrite as N (µg/l)	<1	67
Alkalinity (mg$CaCO_3$/l)	120	3500
Chemical Oxygen Demand (Total)	5.6	310
Total Oxidised Nitrogen (TON)	<0.3	6.3
Total Suspended Solids	8	520
Dissolved Oxygen	<2	9.6
Total Phenols		
Total Phenols (monohydric) (µg/l)	<1	80
Speciated PAH's		
Naphthalene (µg/l)	<0.01	-
Acenaphthylene (µg/l)	<0.01	-
Acenaphthene (µg/l)	<0.01	-
Fluorene (µg/l)	<0.01	-
Phenanthrene (µg/l)	<0.01	-
Anthracene (µg/l)	<0.01	-
Fluoranthene (µg/l)	<0.01	-
Pyrene (µg/l)	<0.01	-
Benzo(a)anthracene (µg/l)	<0.01	-
Chrysene (µg/l)	<0.01	-
Benzo(b)fluoranthene (µg/l)	<0.01	-
Benzo(k)fluoranthene (µg/l)	<0.01	-
Benzo(a)pyrene (µg/l)	<0.01	-
Indeno(1,2,3-cd)pyrene (µg/l)	<0.01	-
Dibenz(a,h)anthracene (µg/l)	<0.01	-
Benzo(ghi)perylene (µg/l)	<0.01	-
Total Speciated PAH's (µg/l)	<0.16	-
Heavy Metals/Metalloids		
Arsenic (dissolved) (µg/l)	0.49	34

Boron (dissolved) (µg/l)	690	89000
Cadmium (dissolved) (µg/l)	<0.02	0.05
Calcium (dissolved)	86	470
Chromium (hexavalent) (µg/l)	<5	17
Chromium (dissolved) (µg/l)	<0.2	5.1
Copper (dissolved) (µg/l)	<0.5	5.1
Lead (dissolved) (µg/l)	<0.2	2.4
Magnesium (dissolved)	12	400
Mercury (dissolved) (µg/l)	<0.05	-
Nickel (dissolved) (µg/l)	<0.5	24
Potassium (dissolved)	8.2	110
Selenium (dissolved) (µg/l)	1.4	40
Sodium (dissolved)	56	3100
Zinc (dissolved) (µg/l)	<0.5	16
Monoaromatics		
Benzene (µg/l)	<1	-
Toluene (µg/l)	<1	-
Ethylbenzene (µg/l)	<1	-
p & m-xylene (µg/l)	<1	-
o-xylene (µg/l)	<1	-
MTBE (Methyl Tertiary Butyl Ether) (µg/l)	<1	-
Petroleum Hydrocarbons		
TPH-CWG Aliphatic >C5-C6 (µg/l)	<1	-
TPH-CWG Aliphatic >C6-C8 (µg/l)	<1	-
TPH-CWG Aliphatic >C8-C10 (µg/l)	<1	-
TPH-CWG Aliphatic >C10-C12 (µg/l)	<10	-

TPH-CWG Aliphatic >C12-C16 (µg/l)	<10	-
TPH-CWG Aliphatic >C16-C21 (µg/l)	<10	-
TPH-CWG Aliphatic >C21-C35 (µg/l)	<10	-
TPH-CWG Aliphatic >C35-C44 (µg/l)	<10	-
TPH-CWG Aliphatic (C5-C35) (µg/l)	<10	-
TPH-CWG Aliphatic (C5-C44) (µg/l)	<10	-
TPH-CWG Aromatic >C5-C7 (µg/l)	<1	-
TPH-CWG Aromatic >C7-C8 (µg/l)	<1	-
TPH-CWG Aromatic >C8 - C10 (µg/l)	<1	-
TPH-CWG Aromatic >C10 - C12 (µg/l)	<10	-
TPH-CWG Aromatic >C12 - C16 (µg/l)	<10	-
TPH-CWG Aromatic >C16 - C21 (µg/l)	<10	-
TPH-CWG Aromatic >C21 - C35 (µg/l)	<10	-
TPH-CWG Aromatic > C35 - C44 (µg/l)	<10	-
TPH-CWG Aromatic (C5 - C35) (µg/l)	<10	-
TPH-CWG Aromatic (C5 - C44) (µg/l)	<10	-
VOC's		
Chloromethane (µg/l)	<1	-
Chloroethane (µg/l)	<1	-
Bromomethane (µg/l)	<1	-
Vinyl Chloride (µg/l)	<1	-
Trichlorofluoromethane (µg/l)	<1	-
1,1-Dichloroethene (µg/l)	<1	-
1,1,2-Trichloro 1,2,2-Trifluoroethane (µg/l)	<1	-

Cis-1,2-dichloroethene (µg/l)	<1	-
MTBE (µg/l)	<1	-
1,1-Dichloroethane (µg/l)	<1	-
2,2-Dichloropropane (µg/l)	<1	-
Trichloromethane (µg/l)	<1	-
1,1,1-Trichloroethane (µg/l)	<1	-
1,2-Dichloroethane (µg/l)	<1	-
1,1-Dichloropropene (µg/l)	<1	-
Trans-1,2-dichloroethene (µg/l)	<1	-
Benzene (µg/l)	<1	-
Tetrachloromethane (µg/l)	<1	-
1,2-Dichloropropane (µg/l)	<1	-
Trichloroethene (µg/l)	<1	-
Dibromomethane (µg/l)	<1	-
Bromodichloromethane (µg/l)	<1	-
Cis-1,3-dichloropropene (µg/l)	<1	-
Trans-1,3-dichloropropene (µg/l)	<1	-
Toluene (µg/l)	<1	-
1,1,2-Trichloroethane (µg/l)	<1	-
1,3-Dichloropropane (µg/l)	<1	-
Dibromochloromethane (µg/l)	<1	-
Tetrachloroethene (µg/l)	<1	-
1,2-Dibromoethane (µg/l)	<1	-
Chlorobenzene (µg/l)	<1	-
1,1,1,2-Tetrachloroethane (µg/l)	<1	-
Ethylbenzene (µg/l)	<1	-

p & m-xylene (µg/l)	<1	-
Styrene (µg/l)	<1	-
Tribromomethane (µg/l)	<1	-
o-Xylene (µg/l)	<1	-
1,1,2,2-Tetrachloroethane (µg/l)	<1	-
Isopropylbenzene (µg/l)	<1	-
Bromobenzene (µg/l)	<1	-
n-Propylbenzene (µg/l)	<1	-
2-Chlorotoluene (µg/l)	<1	-
4-Chlorotoluene (µg/l)	<1	-
1,3,5-Trimethylbenzene (µg/l)	<1	-
tert-Butylbenzene (µg/l)	<1	-
1,2,4-Trimethylbenzene (µg/l)	<1	-
sec-Butylbenzene (µg/l)	<1	-
1,3-Dichlorobenzene (µg/l)	<1	-
p-Isopropyltoluene (µg/l)	<1	-
1,2-Dichlorobenzene (µg/l)	<1	-
1,4-Dichlorobenzene (µg/l)	<1	-
Butylbenzene (µg/l)	<1	-
1,2-Dibromo-3-chloropropane (µg/l)	<1	-
1,2,4-Trichlorobenzene (µg/l)	<1	-
Hexachlorobutadiene (µg/l)	<1	-
1,2,3-Trichlorobenzene (µg/l)	<1	-
1,2,3-Trichloropropane (µg/l)	<1	-
1,3,5-Trichlorobenzene (µg/l)	<1	-
Bromochloromethane (µg/l)	<1	-

Dichloromethane (µg/l)	<100	-
Carbon disulphide (µg/l)	<1	-
Dichlorodifluoromethane (µg/l)	<1	-
Oxygenates by headspace GC-MS		
Diisopropyle ether (DIPE)	<0.1	-
Ethyl-t-butyl ether (ETBE)	<0.1	-
Methyl-t-butyl ether (MTBE)	<0.1	-
t-amyl ethyl ether (TAEE)	<0.1	-
t-amyl methyl ether (TAME)	<0.1	-
t-butylalcohol (TBA)	<0.1	-
SVOC's		
Aniline (µg/l)	<0.05	-
Phenol (µg/l)	<0.05	-
2-Chlorophenol (µg/l)	<0.05	-
Bis(2-chloroethyl)ether (µg/l)	<0.05	-
1,3-Dichlorobenzene (µg/l)	<0.05	-
1,2-Dichlorobenzene (µg/l)	<0.05	-
1,4-Dichlorobenzene (µg/l)	<0.05	-
Bis(2-chloroisopropyl)ether (µg/l)	<0.05	-
2-Methylphenol (µg/l)	<0.05	-
Hexachloroethane (µg/l)	<0.05	-
Nitrobenzene (µg/l)	<0.05	-
4-Methylphenol (µg/l)	<0.05	-
Isophorone (µg/l)	<0.05	-
2-Nitrophenol (µg/l)	<0.05	-
2,4-Dimethylphenol (µg/l)	<0.05	-

Bis(2-chloroethoxy)methane (µg/l)	<0.05	-
1,2,4-Trichlorobenzene (µg/l)	<0.05	-
Naphthalene (µg/l)	<0.01	-
2,4-Dichlorophenol (µg/l)	<0.05	-
4-Chloroaniline (µg/l)	<0.05	-
Hexachlorobutadiene (µg/l)	<0.05	-
4-Chloro-3-methylphenol (µg/l)	<0.05	-
2,4,6-Trichlorophenol (µg/l)	<0.05	-
2,4,5-Trichlorophenol (µg/l)	<0.05	-
2-Methylnaphthalene (µg/l)	<0.05	-
2-Chloronaphthalene (µg/l)	<0.05	-
Dimethylphthalate (µg/l)	<0.05	-
2,6-Dinitrotoluene (µg/l)	<0.05	-
Acenaphthylene (µg/l)	<0.01	-
Acenaphthene (µg/l)	<0.01	-
2,4-Dinitrotoluene (µg/l)	<0.05	-
Dibenzofuran (µg/l)	<0.05	-
4-Chlorophenylether (µg/l)	<0.05	-
Diethyl phthalate (µg/l)	<0.05	-
4-Nitroaniline (µg/l)	<0.05	-
Fluorene (µg/l)	<0.01	-
Azobenzene (µg/l)	<0.05	-
Bromophenylether (µg/l)	<0.05	-
Hexachlorobenzene (µg/l)	<0.05	-
Phenanthrene (µg/l)	<0.01	-
Anthracene (µg/l)	<0.01	-
Carbazole (µg/l)	<0.05	-

Dibutyl phthalate (µg/l)	<0.05	-
Anthraquinone (µg/l)	<0.05	-
Fluoranthene (µg/l)	<0.01	-
Pyrene (µg/l)	<0.01	-
Butylbenzylphthalate (µg/l)	<0.05	-
Benzo(a)anthracene (µg/l)	<0.01	-
Chrysene (µg/l)	<0.01	-
Benzo(b)fluoranthene (µg/l)	<0.01	-
Benzo(k)fluoranthene (µg/l)	<0.01	-
Benzo(a)pyrene (µg/l)	<0.01	-
Indeno(1,2,3-cd)pyrene (µg/l)	<0.01	-
Dibenz(a,h)anthracene (µg/l)	<0.01	-
Benzo(ghi)perylene (µg/l)	<0.01	-
Chlorophenols		
Pentachlorophenol (PCP) (µg/l)	<0.05	0.09

3.5 Gas Monitoring and results

3.5.1 Analytical results for ground gas monitoring are presented in the report referenced in paragraph to 3.2.21 to 3.2.23. These are considered to be representative of the ground gas at the time of submission of the EP application. A summary of reported ground gas results prior to development of REP is presented in Table 3-7.

Table 3-7 - Gas Monitoring Results prior to development of REP

Pollutant	Min Value (% vol) unless stated	Max Value (% vol) unless stated
Methane (% vol)	0	2.5
Methane (% Lower Explosive Llimit)	0	58.8
Oxygen (% vol)	16.8	20.4
Carbon Dioxide (% vol)	0.2	3.7
Carbon Monoxide (ppm)	0	0

Hydrogen Sulphide (ppm)	0	0

3.6 Baseline Reference Data

3.6.1 The data available on ground, groundwater and ground gas contamination is presented in Sections 3.3 to 3.5. Sections 3.3 to 3.5 summarise the range of concentrations recorded in all of the site investigations for a wide suite of determinants.

3.6.2 As stated within Article 22 (2) of the IED:

> *"Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013."*

3.6.3 Prior to commencement of construction, the area of land which REP will be located on will be cleared and prepared for construction. If during clearance and preparation works any contamination is identified, samples will be taken and records retained. Records of any remediation undertaken during the construction phase will also be retained. This information will be used to further update the baseline ground conditions for the installation prior to the commencement of operations.

3.6.4 During construction of REP the site infrastructure, including hardstanding, site drainage, raw material and waste storage facilities will be constructed to provide protection of the underlying ground and groundwater.

4 Permitted Activities

4.1 Permitted Activities

4.1.1 The permitted activity would consist of a combination of Schedule 1 installation activities (as defined in the Environmental Permitting Regulations) and directly associated activities:

Table 4-1 – Permitted Activities

Type of Activity	Schedule 1 Activity	Description of Activity
Installation	Section 5.1 Part A1 (b)	The combustion of non-hazardous waste in a waste incineration with a nominal design capacity of greater than 3 tonnes per hour.
Installation	Section 5.1 Part A1 (b)	The combustion of non-hazardous waste in a waste incineration with a nominal design capacity of greater than 3 tonnes per hour.
Installation	Section 5.4 Part A1 (b)	Recovery or a mix of recovery and disposal of non-hazardous waste with a capacity exceeding 100 tonnes per day, as the waste treatment activity is anaerobic digestion, involving biological treatment.
Directly Associated Activities		The receipt and storage of municipal and commercial and industrial waste prior to incineration.
Directly Associated Activities		The receipt and storage of organic waste prior to anaerobic digestion.
Directly Associated Activities		The handling, storage and transfer of residues for transfer off-site.
Directly Associated Activities		The export of electricity and potential export of heat from the Installation.

4.2 On-site Fuel and Chemical Storage Facilities

4.2.1 As identified in the Supporting Information document, the activities undertaken on site would utilise a number of fuels and chemicals. The primary, secondary and tertiary containment systems associated with the storage of these materials are presented in Table 4-2 below.

Table 4-2 - Chemical and Fuel Containment Facilities

Substance	Number of Storage Facilities	Primary Containment	Secondary Containment	Tertiary Containment
Fuel oil	1	Steel Tank	Bund	Hardstanding
Ammonia	1	Tank	Bund/Hardstanding	Hardstanding
Lime	1	Silo	Hardstanding	
Powdered Activated Carbon	1	Silo	Hardstanding	
Boiler treatment chemicals			Impervious bunding (110% capacity of the storage tank)	Concrete hardstanding
Anaerobic digestion treatment chemicals			Impervious bunding (110% capacity of the storage tank)	Concrete hardstanding

4.3 Environmental Risk Assessment

4.3.1 An Environmental Risk Assessment has been carried out following the Environment Agency Horizontal Guidance Note H1. This is included within Appendix H of the Environmental Permit Application. The assessment considers all potential sources of ground and surface water pollution that could occur due to fugitive emissions or from accidents occurring at REP. The risk assessment also details any mitigation measures that would be employed to reduce the frequency or impact of these events.

4.3.2 The land use and pollution history of the REP site has been considered in this desk study.

4.3.3 The Environmental Risk Assessment identifies that the development would require the storage of various chemicals, which could pose a risk to the ground and groundwater during normal operation. All process areas, loading/unloading areas, materials handling areas and roadways will be covered in concrete and/or tarmac hardstanding. It is therefore not regarded that there will be any risk of ground/groundwater contamination during normal operation of REP.

4.3.4 The Environmental Risk Assessment concluded that for land, groundwater and surface water, the residual impacts from the operation of REP would be insignificant provided the recommended mitigation measures are employed.

4.3.5 It is therefore concluded that the installation would pose little risk of pollution. However, periodic soil and groundwater samples will be undertaken to fulfil the requirements of Articles 14(1)(b), 14(1)(e) and 16(2) of the IED.

4.4 Conclusion

4.4.1 For the reasons stated within this report, it anticipated that there will be little risk of pollution associated with the installation and its directly associated activities.

4.4.2 During the Operational phase of REP, as required by the permit, any records which demonstrate how the land and groundwater have been protected will be maintained. This information would include inspection records of site infrastructure, pollution/incident reports, records of any ground investigations undertaken, and any monitoring records of soil, gas and/or water during the life of the permit. Where it is identified that pollution has occurred records would be maintained to demonstrate any pollution incidents that may have affected the land or groundwater. These records will be retained to be used to inform whether operations or incidents associated with the operation of REP have impacted upon the ground conditions when applying to surrender the EP.

Appendix A Envirocheck Report

Appendix B Site Investigations

B.1 Wilkinson Associates (1992), Report on Site Investigation at Waste to Energy Incineration Plant, Belvedere

B.2 Wilkinson Associates (1992), Report on Site Investigation at Chitty Site, Waste to Energy Incineration Plant, Belvedere

B.3 Wilkinson Associates (1992), Report on Site Investigation at Greenham Site, Waste to Energy Incineration Plant, Belvedere

B.4 Applied Environmental Research Centre Ltd (2003), Site Investigation and Remediation Proposals, Ref: C3477/R1384

B.5 Soil Mechanics Ltd (2007), Factual Report on Ground Investigation, Ref: G7061

B.6 Applied Environmental Research Centre Ltd (2003), Site Investigation and Remediation Proposals, Ref: C3477/R2489

B.7 AMEC Earth and Environmental (UK) Ltd (2008), Method Statement Zone 4 - Main RRRF Plant, Ref: 7888001173/R3094

B.8 AMEC Earth and Environmental (UK) Ltd (2008), Validation of Contaminated Land: Phase 1 0 ‘hotspots’, Ref: C34129/R2976

B.9 AMEC Earth and Environmental (UK) Ltd (2010), Review of Con-Form Report (Con-Form 2010, Validation Report, Final, Ref: C1387/09/01)

B.10 TerraConsult (2018), Riverside EfW, Ref: 3765R001-2 (Appendix K).