DATA REVIEW

SSI2 Redcar Works - Phase 1 Geo-Environmental Desk Study

Prepared for

Homes and Communities Agency

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Contents

Section Page

Appendices

Tables

Figures

Acronyms and Abbreviations

AOD	Above Ordnance Datum
Bgl	Below Ground Level
BGS	British Geological Survey
BOS	Basic Oxygen Steelmaking
BRE	Building Research Establishment
CATS	Central Area Transmission System
CH2M	CH2M Hill
CL:AIRE	Contaminated Land Application in the Real Environment
COMAH	Control of Major Accident Hazards
DEFRA	Department of Environment Food and Rural Affairs
DOE	Department of the Environment
EA	Environment Agency
EPA	Environmental Protection Act
EPA16	A list of 16 priority PAHs as identified by the USA's Environmental Protection Agency
Ha	Hectare
MAGIC	Multi-Agency Geographic Information for the Countryside
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
RBT	Redcar Bulk Terminal
RCBC	Redcar and Cleveland Borough Council
SGV	Soil Guideline Values
SPA	Special Protected Area
SSI-UK	Sahaviriya Steel Industries UK
SSSI	Site of Special Scientific Interest
STSC	South Tees Site Company
S4SL	Category 4 Screening Level
S4UL	Suitable for Use Level
TPH	Total Petroleum Hydrocarbons
UXB	Unexploded Bomb
VOC	Volatile Organic Compound

Executive Summary

SSI2 lies on the northern edge of the Teesside Steelworks complex, directly west of Redcar, Middlesbrough. The site is approximately 84 hectares, centred at Ordnance Survey (OS) National Grid Reference 456443E, 525800N, (ref. Figure 1). To the north is Warrenby village and Coatham Marsh, to the east the Cleveland Golf Links and TS2, to the south SSI1 and to the west Redcar Bulk Terminal.

The site was originally part of the intertidal zone of Bran Sands, with the eastern section formed by a headland area, beyond which was the Middlesbrough to Redcar line. By 1859 South Gare Breakwater had been built, transecting the site in a broadly northeast/southwest alignment; followed by the construction of Coatham Ironworks adjacent to the eastern boundary. By 1915 much of the Bran Sands area had been reclaimed, and numerous tramways crossed the site. The former Redcar Iron and Steel works had been built within the north-eastern area of SSI2 by 1930; north of South Gare Breakwater, and evidence of tipping, most likely of slag was apparent within the area. To the north-east two Slag and Macadam Works had also been built, as well as buildings and structures associated with water storage and treatment, and a Meter House. The land south of South Gare Breakwater largely remained marshland and sand until the early 1950's, during which time Coatham Iron Works and the Slag and Macadam Works sites were demolished. Development of the current Blast Furnace, Coke Ovens, By-Products Plant and Power Plant began during the 1970's.

During WWI and WWII, the manufacturing and industrial sites in Middlesbrough and around Teesside Port made the area a strategic target. The Zetica Regional Unexploded Bomb (UXB) Risk map covering the area classifies the UXB risk to be 'moderate'; based on a "bomb density of 11 to 50 bombs per 1000 acres" and potential WWII targets. Further investigation is required to determine the risk to the site.

Made ground is present across the site associated with its reclamation from the mudflats and marshland. It has historically been described as comprising sand, gravel, cobbles and boulders of ash, brick and slag, of variable thickness, typically ranging between less than 1m to 9m thick. However, in many cases the base of the Made Ground has not been proven. The underlying superficials comprised Tidal Flat deposits of sand and silts, proven to 11m below surface level. Glacial till around 3m thick underlies these and in turn overlies bedrock. The Redcar Mudstone Formation underlies the eastern half of the site, with the Mercia Mudstone Group beneath the western. At their boundary is a thin band of the Penarth Group. Evaporate deposits underlie the site; including at considerable depth the 25m thick Boulby Halite horizon. This has historically been exploited by brine extraction within the wider SSI site.

Although bedrock is classified as a Secondary (undifferentiated) aquifer; the superficials are classified to be a Secondary A aquifer. Furthermore, the site is located within a Groundwater Vulnerability Zone; Minor Aquifer (High), which refers to areas able to easily transmit pollution to groundwater. Teesmouth and Cleveland Coast Special Protection Area and Ramsar Site and South Gare and Coatham Sands Site of Special Scientific Interest are located adjacent to the north of SSI2.

SSI2 holds a COMAH Upper Tier Establishment classification associated with the large quantities of PAH contained within the Coke Oven Gas Main (COG). Historically the site has held licences associated with the release to air and to water of various substances, and the disposal to landfill of Special and Non-special wastes. Several discharge consents breaches have occurred relating to the release of water; and effluent from the Water Treatment Plant into the River Tees. Although no landfills are recorded within SSI2, the historical Warrenby site; which accepted inert and industrial waste is located 100m to the north, adjacent to Redcar Blast Furnace.

The features of concern on site are the former Iron and Steel Work, the Slag and Macadam Works site and the stocking areas. Others include the existing Redcar Blast Furnace, Coke Ovens, COG, By-Products Plant, Power Station, sub-stations, fuel storage areas, road and rail bridges and the various former and

existing railway lines. These may be potential sources of contamination; which may include asbestos, heavy metals, PCBs, hydrocarbons and inorganic compounds including sulphides /sulphates / carbonates. Asbestos should be presumed to be within all Made Ground deposits, and therefore will need to be included in piling risk assessment should piles be proposed. Heavy metals, sulphates, hydrocarbons and coal tar are also present throughout the Made Ground. However, a variety of proven and established technologies are available to deal with these contaminants. Potential options include the use of clean cover systems, bioremediation and thermal desorption. The type of remediation will depend on the type, concentration and extent of contamination, and risk to potential receptors.

Certain types of slag may pose a risk to future buildings and structures due to their potential to exhibit volumetric instability. It can also weather resulting creating tufa (calcium hydroxide and calcium carbonate precipitates), which can be mobilised in surface and groundwater leading to damage to drainage infrastructure and unsightly deposits in watercourses. Slags are also characterised by elevated sulphate content, which will need to be considered when specifying concrete. Characterising the slag will enable the most problematic materials to be identified and if necessary removed; with the remaining material, mainly free of expansive slag. This slag can then be processed by crushing and blending to homogenise it, creating a usable fill. Processing the slag in this way will allow any discrete pockets of expansive materials to become disseminated with the fill. The processed slag is then allowed to hydrate over a period of months to promote any expansive reactions, before being placed in layers to distribute any remaining problem materials laterally.

By the nature of their deposition the underlying superficial Tidal Flat deposits are highly susceptible to compression resulting in excessive settlement, whilst their high organic content would also likely lead to long term secondary compression. This will need to be considered within the design of any future developments on site.

Introduction

CH2M was commissioned in May 2016 by the Homes and Communities Agency to undertake a Development Viability Assessment, largely comprising desk top technical studies, on the former Redcar (Sahaviriya Steel Industry (SSI)) Steelworks, following the site closure in October 2015. The SSI assets are currently in the hands of the Official Receiver, and permission to access the land and the information database held on site was granted in November 2016. The scope of the DVA was subsequently widened to include land in the ownership of TATA Steel, which is situated within the proposed South Tees Development Corporation (STDC) area, to inform the emerging Masterplan.

This document reports on a Phase 1 geo-environmental desk study, including site walkover surveys undertaken in March 2017, which aimed to review all information available pertaining to ground conditions and contaminated industry indicators, giving an overview of the existing ground conditions, including consideration of asbestos, and making recommendations for further studies and physical ground investigation works to inform future development of the wider STDC area.

1.1 Terms of reference

This report is based on the information that has been acquired and/or made available to us via the various searches and consultations undertaken as part of the Desk Study exercise. In some cases anecdotal information has been relied upon, where documented evidence has been lacking.

The conclusions drawn in the report are considered correct although any subsequent additional information may allow refinement of the conclusions. It should be noted that:

- The report has been prepared in accordance with the instructions of our client, the Homes and Communities Agency, for their sole and specific use, or, by prior agreement, any party to whom the client is permitted to assign or transfer its rights under its contract with CH2M. Any other persons who use any information contained herein do so at their own risk.
- All work carried out in preparing this report has utilised and is based upon CH2M's current professional knowledge and understanding of current relevant UK standards and codes, technology and legislation. Changes in this legislation and guidance may occur at any time in the future and cause any conclusions to become inappropriate or incorrect. CH2M does not accept responsibility for advising the Homes and Communities Agency or other interested parties of the facts or implications of any such changes.
- This report has been prepared using factual information contained in maps and documents prepared by others. CH2M can accept no responsibility for the accuracy of such information.

This site forms part of the wider South Tees Development Corporation area, covering some 4,500 acres, and this report refers only to the area designated as SSI2, referred to from now on as "the site".

1.2 Site location and description

The SSI 2 site lies on the northern edge of the Teesside Steelworks complex directly west of Redcar, Middlesbrough, Cleveland, TS10 5BE as shown on Figure 1. The site covers an area of approximately 84 hectares (Ha) and centred at Ordnance Survey (OS) National Grid Reference 456443E, 525800N. The site is bordered to the north by Warrenby and Coatham Marsh, to the east by the Cleveland Golf Links and the TS2 site area, to the south by the SS1 site area and to the west by the Redcar Bulk Terminal.

The SSI2 site area formed the main production area of the Redcar Steelworks and includes the Blast Furnace, Power Station, Coke Ovens and by-product plant, and stores as shown on Figure 2.

Sources of Information

2.1 Landmark

Environmental data from government agencies was provided by Landmark Group Ltd in GIS format order ref 90671997.

A Landmark Envirocheck report was commissioned, which assimilates information from a number of sources, including:

- OS Map Data
- The Environment Agency
    - Flood risk
    - Hydrogeology
    - Groundwater abstraction and protection
- Natural England
- Coal Authority
    - Information on historical coal mining activity.
- Public Health England

2.2 Environment Agency

Information on flood risk, hydrology and hydrogeology and landfills was obtained from the Environment Agency (EA) at: http://apps.environment-agency.gov.uk/wiyby/default.aspx.

2.3 Multi-Agency Geographic Information for the Countryside

Multi-Agency Geographic Information for the Countryside (MAGIC) is a partnership project involving the Department for Environment, Food and Rural Affairs (DEFRA), Historic England, Natural England, Environment Agency, Forestry Commission and Marine Management Organisation. The MAGIC website http://magic.defra.gov.uk/MagicMap.aspx provides geographic information about the natural environment from across government. The information covers rural, urban, coastal and marine environments across Great Britain. It is presented in an interactive map which can be explored using various mapping tools that are included. Users do not require specialist software and can access maps using a standard web browser.

2.4 British Geological Survey

Geological mapping and published exploratory hole logs have been reviewed via the British Geological Survey (BGS) online GeoIndex database. The data is listed in Table 2.1:

Table 2.1 – BGS Records

Title	Information
BGS 1:50,000 scale GeoIndex Onshore (online) Sheet 34: Guisborough. Solid and Drift (1998)	Geological information, solid and drift at 1:50,000 scale
BGS 1:50,000 scale GeoIndex Onshore (online)	Solid and superficial geology, faults and other linear features of the area
Historical boreholes in or adjacent to the site. Note many of the boreholes are marked as confidential. However, these are also available (in part) within the SSI UK site records (see section 2.6)	NZ52NE12 to 17, NZ52NE48, NZ52NE51 to 52, NZ52NE54, NZ52NE56 to 59, NZ52NE84 to 89, NZ52NE91, NZ52NE96 to 102, NZ52NE104, NZ52NE108 to 119, NZ52NE122, NZ52NE124 to 126, NZ52NE129, NZ52NE135,

2.5 Redcar and Cleveland Borough Council

High resolution aerial photography was provided by Redcar and Cleveland Borough Council (RCBC).

Historical mapping for the area was provided by RCBC in a GIS geodatabase.

2.6 SSI (UK)

Historical site information and plans were obtained via the Sahaviriya Steel Industries UK (SSI UK) 'Cabinet' site record; (SSI UK, formerly Corus, formerly and British Steel). Where other previous reports have been obtained, these are listed in Section 2.9. Drawings used in this report are listed in Table 2.2.

Table 2.2 – Historical Site Information

Drawing name	Drawing number	Author/Company	Data
Ownership of HV Substations on Teesside Works	5002-E7221	British Steel Corporation	Substation Locations within SSI2
Engineering Workshop 1975	RGEN2164		Floor and Roof Layouts
Engineering Workshop 1975	RGEN2166		GA Ground Floor
Engineering Workshop 1975	RGEN2167		GA Ground Floor, slab details
Engineering Workshop 1975	RGEN2430		Elevations
Engineering Workshop 1976	RGEN3045		Fabrication, electrical Tackle and Welding shops
Engineering Workshop 1976	RGEN3193		Fabrication, electrical Tackle and Welding shops power GA
General arrangement of Access Ramps and Cast House Floor Extensions 1978	RBF11645		General arrangement including details on piles

Table 2.2 – Historical Site Information

Drawing name	Drawing number	Author/Company	Data
RBF1/1 Cast House Services	RBF11878	British Steel Corporation	Redcar Blast Furnace Ancillary Buildings includes location of oil injector room
Redcar Blast Furnace Cast House Layout 1975	RBF1751		General layout
Blast Furnace and Cast House Pile Layout 1974	RBF244		Layout for 80Tonne and 110Tonnes piles - total No 319
Blast Furnace and Cast Layouts of Foundation	RBF245/ RBF247 to 248		
Ironworks Technical Centre Ground Floor Plan	RGEN2719,		Includes plant room, laboratory, chemical store
Ironworks Technical Centre Ground Floor Plan	RGEN2720		Reference to finish details that includes Asbetolux tiles (Asbestos containing tiles)
Ironworks Technical Centre Ground Floor Plan	GGEN 2721		Reference to Coke/coal laboratories, water analysis , chemical room, Glass Chemical , By-Products lab and plant room
Layout – By Products	X-103151		Layout of By Products Plant
Layout of Boreholes and Dutch Deep Soundings	RGEN136		Borehole layout based on pre 1979 refit of the Steelworks.
Ground Sections IV	RGEN132		Cross Section through site area on Section 9.
Key Plan showing Borehole Locations	X57642		Borehole layout in relation to existing steelworks layout
Cooling Water Outfall	RPS110 to RPS117		Plan and Longitudinal Section of cooling water outfall
General Plans and Layouts	A114563	British Steel Sections, Plates and Commercial Steels	Key plan for Service Checks - Buildings
Layout of Plant	A56663		Site layout Information
Layout of Plant	X56037		Layout of no1 Blast Furnace
Layout of Plant	X56346/X56347		Layout of no1 Blast Furnace

Table 2.2 – Historical Site Information

Drawing name	Drawing number	Author/Company	Data
Coke Oven Gas	A117462	British Steel Teesside Works	Teesside works showing coke oven gas system
Layout of Redcar Blast Furnace main	A-122995	Corus Northern Engineering Services	Layout of gas main linking to gas holder and flare stack.
Area 11 Cross Section and plan	A119591	Corus Teesside Works	Plan and Cross Section through Power Station Area showing location of hydrocarbon storage areas and proposed sampling point.
Area 10 Potentially polluting substances and relevant activities	A119590		Plan and Cross Section through No 1 Blast Furnace Power Station Area showing location of hydrocarbon storage areas and proposed sampling point. Shows location of discharges to ground associated with Slag pits and flue dust
Layout of Main Redcar Area Workshops - 2001	A-118793		Building layout
Floor Plan of Underground Air and Power - 2005	A-120682		Area workshops power supply. LPG Store
Cast House Services Building Civils Details	RBF1297	Davy Ashmore International	Oil injector, reservoir and emulsifier locations
Office Outline Accommodation - 1967	A-32540	Doorman Long (Steel) Ltd	Arrangement of Offices
Layout showing Tipping Areas Redcar Works - 1968	A34201		Historic plant layout
Plan Elevations Coke Handling Plant - 1973	RC0638	Gibbon Brothers Ltd	Rail loading stations for 100 and 50 tonne bunkers
Arrangements of Coke Handling Plant - 1973	RC0642		Layout coal stocking and Distribution bunkers
Coal and Coke Handling - 1973	RC0920		Layout
General Arrangements of Coke Handling Plant - 1973	RC0679	International Combustion Ltd	Layout coal stocking and Distribution bunkers
Route of AMOCO CATS 36'' Pipeline across	A114418	SSI LTD	15m easement for works within 15m of pipeline

Table 2.2 – Historical Site Information

Drawing name	Drawing number	Author/Company	Data
British Steel Redcar Works		SSI LTD	
Teesside Works Layout showing Fuel Oil System usage	A-123797	TATA Steel	Route runs along southern boundary service reservation with offset into the power station, blast furnace and storage tank area.
Teesside Works showing outfalls soakaways and culverts and drains	A123824		Outfall to River Tees, Coke Oven Firefighting soakaway, power station outfall, slag quench tank

Drawings RGEN136 and X57642 provide the location for a number of the historical ground investigation positions across the site area conducted in the 1970's. The SSI UK 'Cabinet' site records also contain a large number of borehole records however the record is incomplete and it is not possible to reconcile the records with the base plans with confidence. Appendix A contains a copy of boreholes layout plans RGEN136 and X57642. The borehole records are discussed in Section 3.5.

2.7 Coal Authority

The Coal Authority database https://www2.groundstability.com/ was reviewed to identify risks from historical coal mining at the site.

2.8 Zetica

A regional unexploded ordnance (UXO) risk map has been obtained from Zetica.

2.9 Previous Studies

Table 2.3 outlines the previous studies which have been made available for the site.

Table 2.3 – Previous Studies

Document title and date	Author (client)	Information summary	Document reference in this report.
Desk Study Report SSI Steelworks – October 2016	Redcar and Cleveland Borough Council – Environmental Protection Team People Services Public Health	Assessment of contaminated land under Part 2A of the Environmental Protection Act 1990. Conclusion that the site has been assigned a Category 2 Classification due to the potential significant risk to controlled waters. Risk Category based on the 2012 Defra Statutory Guidance for Sites investigated and Risks assessed under Part 2A of	RCBC DSR (2016)

Table 2.3 – Previous Studies

Document title and date	Author (client)	Information summary	Document reference in this report.
		the Environmental Protection Act 1990.	
CORUS UK Ltd Soil and Groundwater Baseline Characterisation Study Teesside Works June 2004	Enviros Consulting Ltd	3 volumes: Volume 1: Factual Volume 2: Interpretive Volume 3: Executive Summary Includes within site 10 boreholes 53 Trial pits. The interpretive report and executive summary includes a conceptual site model as well as an assessment of risks to potential development.	Enviros (2004) **Appendix B – Volume 1 - Factual Report Extract**
Report into the condition of Redcar Power Station in preparation for keeping it safe.	SSI UK Ltd	The report provides a brief history and function of the Station and how it operated within an integrated Iron and Steelworks and the legacy following closure.	SSI UK RPS (2016) Appendix C1
Report into the condition of Redcar Coke Ovens in preparation for keeping it safe.	SSI UK Ltd	The report provides a brief history and function of the Coke Ovens and how they operated within an integrated Iron and Steelworks and the legacy following closure.	SSI UK RCO (2016) Appendix C2
Report into the condition of Redcar Blast Furnace in preparation for keeping it safe.	SSI UK Ltd	The report provides a brief history and function of the Blast furnace ion and how it operated within an integrated Iron and Steelworks and the legacy following closure.	SSI UK RBF (2016) Appendix C3
Report into the condition of the Non-Aligned Buildings in preparation for keeping it safe.	SSI UK Ltd	The report provides a brief history and function of the buildings and the legacy following closure.	SSI UK NAL (2016) Appendix C4
Report into the condition of the Workshop	SSI UK Ltd	The report provides a brief history and function	SSI UK WBS (2016)

Table 2.3 – Previous Studies

Document title and date	Author (client)	Information summary	Document reference in this report.
Buildings and Structures in preparation for keeping it safe.		of the various workshops around the site and includes the Maintenance Workshops and Store (M1, M8 and M11) and the legacy following closure.	Appendix C5
Report into the condition of the Services in preparation for keeping it safe.	SSI UK Ltd	The report provides a brief history and function of the various workshops around the site and includes the Maintenance Workshops and Store (M1, M8 and M11) and the legacy following closure.	SSI UK SR (2016) Appendix C6

Site Information

3.1 Introduction

The following information has been obtained from the data sources listed in Section 2 together with a site walkover.

3.2 Historical Development

The historical development of the site is detailed in Table 3.1. Based on these researches Figure 3 highlights the main historical features associated with the site.

Table 3.1 - Historical Development at SSI2

Mapping Date	Map Scale	Site Use
1856/7	1:2,500	The site is shown to lie within the area of Bran Sands an intertidal area to the south of a breakwater structure. The extreme eastern section of the site appears to be formed by a headland area including a section named 'Tod Point'. To the east of Tod Point the Middlesbrough to Redcar Railway Line (Darlington and Saltburn Branch) is present (constructed 1846 – Wikipedia, 2017).
1859	N/A	Development of South Gare Breakwater. This transects the site in an approximate north east/south west orientation and was largely composed of blast furnace slag (Wikipedia, 2017).
1874	N/A	Development of Coatham Ironworks 1873 (adjacent to the eastern site boundary) and Redcar Iron Works 1874 (within the TS2 site area). (archaeologydataservice.ac.uk.pdf-2017).
1894	1:2,500	Areas of Bran Sands have been reclaimed. The South Gare Breakwater is shown to be present with a tramway running on top of the structure. This leads to wharfing facilities on the River Tees and eventually to the South Pier Lighthouse. To the north of the South Gare breakwater there has been further over tipping of the Bran Sands and the formation of Tramways. These can be traced to the east of the site to the Coatham Iron Works. Further tramways lead to the Redcar Iron Works that lay within the TS2 site area.
1915	1:2,500	Further reclamation of Bran Sands. Limited changes within site area.
1930	1:2,500	Development of the Redcar Iron and Steel works in the north eastern section of the site (to the north of the South Gare Breakwater. Within this area the site is mainly covered by large buildings (noted as a Steel Plant and Coil Processing Plant on drawing A34201) and a supporting rail/tramway network. Large areas of over tipping presumably with slag waste are also evident. Two areas of Slag and Macadam Works are shown in the north eastern area of the site. Just to the north of the site the Warrenby Slag Works is recorded. Facilities shown on site include a reservoir, water tower and water coolers, a pumping station and a meter house. To the south of the breakwater the area is shown as marshland and sand. Tramways are shown leading out into the area and over tipping with presumably slag waste is taking place.
1953/4	1:1,250/1:2,500	Main building pattern within the site remains the same although some additional buildings are present. Extensive areas of tipping has taken

Table 3.1 - Historical Development at SSI2

Mapping Date	Map Scale	Site Use
		place within the north eastern area of the site and to the north of the site. In addition large areas of over tipping has taken place to the south of the South Gare Breakwater. This has resulted in the creation of marshland areas. The Coatham Iron Works to the east and the Warrenby Slag Works to the north are no longer recorded and only one area of Slag and Macadam Works is recorded within the site. A well is recorded to the south of the breakwater.
1970		Main period of redevelopment of the site including the Blast Furnace, Coke Ovens, By-Products plant and Power Plant.
1981 to 1983	1:1,250/1:2,500	Comprehensive redevelopment of the site area has taken place now annotated as the Teesside Works Redcar this includes the blast furnaces, coke ovens, Power Plant, by –products plant coal, offices and stores.
2000*	-	Majority of the site as shown in 1983. An area of apparent active land raising is taking place to the east between the internal road /rail link and the Fleet channel.
2006*	-	No apparent change
2008*	-	Limited changes evident
*from Historical Google images.		

3.3 Utility Apparatus

Figure 4 shows the location of existing utility apparatus within SSI2 or adjacent to the boundary. This does not include the location of local services for which further investigation is required. The following utilities are recorded:

- BT Openreach Underground cables
- BOC Oxygen Pipeline
- BOC Nitrogen Pipeline
- BOC Hydrogen Pipeline
- Northern Gas Network
- Northumbria Water Limited - Clean water
- Northumbria Water Limited - Sewer
- Northern Power Grid – underground electricity
- Coke Oven Gas Main
- Industrial Water
- Fuel Oil Pipeline
- Cooling Water Discharge

The location of utilities shown on Figure 4 does not included details regarding local distributions and local supplies to and within buildings on site. Furthermore there is a possibility that temporary utilities routes may also exist on site which may or may not be redundant.

3.4 Site Inspection

The site is relatively flat throughout. A series of bunded pits (Ponding Area) are located within the far north-eastern area of the SSI2 into which excess molten iron was tipped and allowed to cool. The pits are approximately 3m deep, 50m in length and 10m in wide. Numerous piles of slag and waste materials were noted throughout this area. The area to the south of the ponding area surface is undulating and contains relic foundations and floor slabs scattered throughout.

Redcar Coke Ovens and By-Products Plant dominate the south-western area of SSI2. The ovens comprised two batteries separated by a Control House of brick construction. Overhead conveyors supplied coal which was fed into a carts running along the top of both batteries. Three large electric Coke Pushers located on the south side of the ovens ran on tracks alongside, pushing out the coke into carts on the north side. Hot coke was taken by locomotive to quenchers located at either end of the batteries, where water was added to the coke to rapidly cool it. The coke was then transferred to the Coke Wharf on the north side of the ovens and sprayed again with water before being transferred onto conveyors which transported the coke underground and to the stocking areas. Due to the volume of water used in quenching, large diameter industrial water and grey water pipes cross-cut this area, with a number of deep valve pits located where pipes intersect or change direction. A number of sub-stations and transformer pens are located in the area south of the ovens, with the two tall chimney stacks here being fed by underground pipes.

Gas produced by the process was cleaned and treated in the By-Products Plant located adjacent to the north. Access to this area was restricted at the time of inspection. The resulting clean gas was stored within two large gas holders, east of the By-Products Plant and use in the Blast Furnace, Power Station, or as fuel elsewhere within the wider SSI site. The gas was transported via the elevated Coke Oven Gas Main, a section of which runs parallel to the southern boundary of SSI2. Condensate pits are periodically located along its length.

Coke stocking areas are located north of the By-Products Plant and include a CRYOS Plant for butane, liquid nitrogen and oxygen; and a concrete bunded Fuel Oil Tank Farm. A number of dumped redundant tanks and small piles of waste, including old slag and ash were noted within this area and the stocking areas at the time of the walkover.

The Blast Furnace is to the east of the stocking areas. On its western side is the waste water Clarifier, with Bag Filter Plants located either side. The Hot Metal (railway) Track runs through the centre of the Blast Furnace, connecting it with the Basic Oxygen Steel (BOS) Plant in the SSI3 site area. The track also connects to tracks and siding running along the northern and eastern perimeters of SSI2. Railway ballast is of slag, with ketch (a waste product of the iron making process); scattered around the area of the Blast Furnace. The Slag Quencher Pump House and associated water pits and tanks are located north of the Blast Furnace, with Slag Pits to the northeast and southwest sides. Stores, workshops, garages and Cooling Plant are located east of the Blast Furnace, as well as a concrete bunded Fuel Oil Tank Farm and fuel loading area. Intermediate bulk containers for waste oil were noted within a former car parking area.

The Power Station is located south of the Blast Furnace, south of which is the overhead Coke Gantry and Technical Centre. To the north are a series of deep water pipe pits, a sub-station, transform pens and transformer oil cooler. Along the eastern side of the Power Station a small boiler was noted, with caustic soda and fuel oil tanks along the south side. To the west are transformer pens and an emergency diesels generator with diesel tank, beyond which is the elevated Coke Oven Gas Main and periodically condensate pits and steam dump valves. A large pond has been excavated east of the Power Station, beyond which are a series of workshops, offices, stores and a substation, collectively referred to as the Area Workshops and Blast Furnace Stock House. Fuel tanks are also located within these areas.

Steel barriers, demarcate service or cable reservations which run throughout SSI2.

3.5 Geology & Ground Conditions

3.5.1 Made Ground

A large area of the site was reclaimed from mudflat and marshland and by the 1870s large areas of the site were subject to over tipping (land raising) as a result of the development of the South Gare Breakwater and the development of the Coatham Iron Works. Based on the Enviros (2004) ground investigation together with historical borehole evidence from the 1970's the Made Ground consists of sand, gravel cobbles and boulders of ash, brick and slag ranging between less than 1.0 and 9.0m in thickness. In many cases the depth of Made Ground was not proved but was recorded to extend to depths exceeding 4.0mbgl. Figure 5 details the location of the Enviros boreholes and also on the basis of the SSI UK cabinet details the base depth of the Made Ground across the site area based on historical borehole data. As noted in Section 2.6 these records are not complete.

3.5.2 Superficial Geology

The BGS 1:50,000 scale maps show that the superficial deposits at the site are predominantly Tidal Flat deposits of sands and silts. Based on the Enviros (2004) data this consists of a fine to coarse sand with shells. Borehole records from the 1970's suggest the thickness of the sands to extend to a maximum proved thickness of 11m below surface level. These are in turn underlain by approximately 3.0m of Glacial Till.

3.5.3 Solid Geology

The BGS 1:50,000 scale bedrock map records the eastern half of the site to be underlain by the Redcar Mudstone Formation of Jurassic age. The BGS Lexicon describes the Redcar Mudstone Formation as grey, fossiliferous, fissile mudstones and siltstones with subordinate thin beds of shelly limestone in lower part, and fine-grained carbonate-cemented sandstone in upper part with argillaceous limestone concretions throughout.

The western half of the site is predominantly underlain by the Mercia Mudstone Group - mudstone of Triassic age (formerly named as the Keuper Marl). At the boundary between the two units is a thin band of Penarth Group Strata also of Triassic age. The Mercia Mudstone Group is described as "dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite-bearing units in some basinal areas. Thin beds of gypsum/anhydrite are widespread and sandstones are also present". The Penarth Group is described as "grey to black mudstones with subordinate limestones and sandstones that are predominantly marine in origin".

The succession is inclined to the north-northwest at approximately 14 degrees.

At considerable depth (>350m) beneath the area are Permian age evaporate deposits that includes the Boulby Halite horizon which is a salt bed measuring approximately 25m thick. This deposit has been exploited by brine extraction from within the wider Steelworks site area.

3.6 Hydrology and Hydrogeology

3.6.1 Hydrology

The River Tees is approximately 0.50 to 1.0km to the west of the site boundary and is classified by the EA as a Main River. This section of the river is intertidal.

3.6.2 Flood Risk

The Environment Agency (EA) Flood Map for Planning (Rivers and Sea) defines the following classification:

The site is classed as Flood Zone 1. The EA defines Flood Zone 1 as areas where flooding from rivers or the sea is very unlikely. There are no flood defences within 250m of the site. There are no areas used for Flood Storage within 250m of the site. There are no areas benefitting from flood defences within 250m of the site.

3.6.3 Hydrogeology

The EA interactive groundwater map defines Groundwater Source Protection Zones for wells, boreholes or springs used for public drinking water supply. The EA mapping shows that the site is not in a Groundwater Source Protection Zone.

The EA's aquifer designation maps record the superficial deposits at the site (tidal flat deposits) to be a Secondary A Aquifer over the eastern half of the site and a Secondary (undifferentiated) Aquifer over the western half of the site.

The EA's aquifer designation maps record the bedrock geology as primarily a Secondary (undifferentiated) Aquifer with a Secondary B aquifer over the north western section of the site.

The site is also mapped within a Groundwater Vulnerability Zone Minor Aquifer (High) i.e. a minor aquifer in areas able to easily transmit pollution to groundwater.

Information contained in the Enviros (2004) report indicates that groundwater levels range between 2.5m and 4.0m AOD with a general north and westerly flow.

3.7 Man-made features

This section covers the existing man made features:

3.7.1 Former Teesside Works

During the 1970s the existing Steel Works was constructed resulting in the demolition of the previously existing iron and steel works. The site includes the following elements:

3.7.1.1 Blast Furnace

The blast furnace (opened in 1979) is located on the northern perimeter of the site. This had a 14m hearth diameter and a working volume of 3,638m^3. The blast furnace was charged with coke, iron ore, sinter and fluxes that were weight batched on a continuous basis. Air produced at high pressure in the power station was then passed through the furnace where it was heated to temperatures in the region of 1,000 to 1,200°C. The air then at high pressure and temperature was injected together with the pulverised coal via 'tuyere' valves located approximately one quarter of the way up the blast furnace. Once the reduction process had occurred the molten iron and slag were periodically tapped from the hearth level. From here liquid iron was transferred to the Basic Oxygen Steelmaking (BOS) plant in refractory lined vessels known as 'torpedo ladles'. These travelled on the Hot Metal rail route to the BOS Plant located on the SSI3 site.

In 2012/13 SSI constructed a pulverised coal injection plant in order to reduce the coke and fuel oil requirement at the plant and improve the overall performance of the furnace.

Located adjacent to the blast furnace on the eastern and western edges were slag pits that allowed the molten slag to discharge and cool. Quench ponds were also located adjacent to the slag pits. Associated with the slag pits were slag processing units for granulation and palletisation of slag. Facilities for gas

cleaning were located directly north of the blast furnace, these were also linked to the gas storage tank (see 3.7.1.5).

A total of four external combustion hot blast stoves were located between the power station and the blast furnace. These were used to pre-heat air prior to injection into the blast furnace. Each stove is 39m high at its highest point and lined with refractory materials.

3.7.1.2 Power Plant

The Power Station construction started in March 1975 and was fully constructed ready for the Blast Furnace commissioning in the summer of 1979. The station included associated outlying systems and an Estuary Cooling Water Pump house situated approximately one mile from the Station on the Tees bay. The Station was shut down by October 2015 (SSI UK RPS 2016).

The Power Station was a fully integrated facility that used Blast Furnace Gas (BFG) and Coke Oven Gas (COG) arising from the Iron making process.

The site comprised:

- 3 Traditional Water Tube Boilers
- 2 Steam Turbine driven Axial Compressors
- 2 x 30MW Steam Condensing Turbo Alternators
- 2 Back Pressure Turbo Alternators
- 200m^3/hr Water Treatment Plant
- Estuary Water Pumphouse with 3 Cooling Water Pumps.

A 200m^3/hr Water Treatment Plant was necessary to provide make up water for steam lost during the steelmaking process. The demineralised plant consisted of a filtration section, followed by ion exchange units and then a final mixed bed polishing stage. The plant also housed chemical regeneration equipment and large underground storage tanks.

3.7.1.3 Coke Ovens

Formed of two batteries of 66 ovens, 5.36m high located on the south western section of the site. These were first built in 1978 (SSI UK RCO 2016). At this facility coal was heated in air-tight ovens to temperatures in the region of 1,200 to 1,300°C for approximately 18 hours. The coke was then pushed out of the oven and quenched in water. This section of the site includes the ovens, a control house, settling ponds, a quench stations, oil store, a pusher track for coal delivery and a coke wharf. In addition, a series of underground pits and sumps are present that were used for the collection of tars, liquors and oils etc. Coke making ceased at the site in October 2015.

3.7.1.4 By-Products Plant

An integral part of the coke generation process was the recovery of By-Products (SSI UK RCO 2016). Volatile matter driven off the coal by the coking process was collected and cooled into a liquid condensate stream and gas stream. The By-Products plant recovered the by-products and also conditioned the gas for reuse. The treatment removed tar aerosols, ammonia, naphthalene and light oil. The by-product plant therefore contains a complex arrangement of tanks and facilities for the processing of the gas/storage of gas and included coolers and exhauster facilities, precipitators, pump houses, control facilities, including a gas booster house, creosote tanks, benzole tanks, washer sand scrubbers, heat exchangers, naphthalene washers, light tar tanks, heavy tar tanks circulating liquor tanks, caustic and lime tanks, waste water treatment facilities and ammonia liquor tanks.

3.7.1.5 Blast Furnace Gas Storage tank

To the east of the By-Products plant is a 90.50m high 49.2m wide gas holder used for the storage and pressure regulation of blast furnace gas. This is linked to the blast furnace, power station and to a flare stack located south of the gas holder. The volumetric capacity of the tank was 150,000m^3.

3.7.1.6 Fuel Oil Pipeline and Storage Tanks

The fuel oil pipelines run along the southern boundary of the site within a service corridor with offsets linking to the Power Plant and the Blast Furnace. In addition, this links to the fuel storage area which is located to the west of the Blast Furnace on the northern site boundary. Heavy fuel oil was used across the wider steelworks but specifically within the site it was injected into the blast furnace and as a fuel source for the power station. The fuel storage area consisted of three 5,000,000 litres tanks and a 2,000,000 litre waste oil tank.

3.7.1.7 Stock House including Coal Bunkers and Ferrous Material Bins

Located on the south eastern side of the site area these buildings linked to large overhead conveyors that supplied raw materials to the top of the blast furnace.

3.7.1.8 Sub stations

A total of 18 substations are included within the site area as detailed in Table 3.2.

Table 3.2 – Substations

Sub Station No	**Sub Station Name**
1	Coke/Ore 66kV
3	Coke Oven Primary 11kV
21	By Products 11/3.3kV
22	Preheater 11/3.3kV
23	HCN/HS2 Stretford 11/3.3kV
32	Blast furnace 11/3.3kV
33	Stock house 3.3kV
34	ERT 11 kV
35	Power Station 66kV
36	Power Station 11/3.3kV
38	TA3 & adjacent 66kV TX PEN
39	TA4 & adjacent 66kV TX PEN
71	Effluent
72	Stretford Effluent
73	Compressor House
74	Interbattery 415v
75	No1 Quench
76	Coke Handling

3.7.1.9 Liquid Nitrogen pipeline and Storage plant

This runs along the southern boundary of the site within a service corridor with offsets linking to the Power Plant and the Blast Furnace. In addition, this linked to the Liquid Nitrogen Cryoplant which is located to the west of the Blast Furnace on the northern site boundary.

3.7.1.10 Ponding areas

Located on the eastern perimeter of the site north of the rail routes are a series of nine ponds that were used for the disposal of waste products from the Blast Furnace, or for excess molten iron that was unable to be processed by the BOS plant. The ponds covered an area of 8,000m^2 with a capacity to hold 60,000t of iron.

3.7.1.11 Coke Oven Gas main

The Coke Oven Gas Main runs above ground along the southern boundary of the site with offsets linking to the Power Plant and the By-Product Plant. This system allowed surplus gas from the coke ovens to be distributed across the wider steelworks site area. The main includes a series of condensate pits which were used to temporarily store condensate. These were cleaned via a suction tanker during the site operation.

3.7.1.12 Coal Stock Area

Located north of the By-Product plant this was fed both into the coking works and into the pulverised coal injection plant. This included a weighbridge hopper facility conveyors and dust suppression and extractions systems.

3.7.1.13 Cooling Water Discharge Shafts and Tunnel

Cooling water discharge was via an approximate 2km long tunnel that ran approximately north into the estuary. This includes two shafts within the SSI2 site that are located north of the Power Plant. Shaft A commenced in a 12.5m x 11.0m shaft (this reduces to a 6.30m diameter shaft at a depth of approximately 5.6m bgl) that is linked to a high-level tunnel at approximately 14.5m bgl. The high level tunnel is approximately 60m long and links to Shaft B. Shaft B is recorded as 3.4m in diameter and links the surface to the 2.0km long tunnel (3.70m diameter) at a depth of approximately 53m bgl. Two offshore shafts link to the tunnel both at 2.40m in diameter.

3.7.1.14 Offices Stores etc

Throughout the site offices and stores supported the various facilities around the site. These facilities include the Redcar Maintenance Workshops, Redcar Heavy (RDL) Stores and Redcar Technical Centre (SSI UK NAL 2016)

3.7.1.15 Road and Parking Areas

An internal infrastructure road network runs through the site linked to several parking areas.

3.7.1.16 Railway Lines

The Hot Metal Route railway line links to the site via the TS2 site area. This line was used to transport the liquid metal in the Torpedo ladles to the Basic Oxygen Steelmaking plant located approximately 7km to the south within the SSI3 site. In addition to this route numerous other rail lines link the various processes on site.

3.7.1.17 CATS Pipeline and Pipe Crossings

Adjacent to the eastern boundary of the site is a Central Area Transmission System (CATS). This is a 36” (91cm) diameter gas pipeline running from the North Sea; this landfalls northeast of the site. The

pipeline started operating in 1993. While unlikely to be contaminative, it is an extremely sensitive asset and worthy of note.

3.8 Unexploded Ordnance

Middlesbrough and the Teesside Port area were home to many iron, steel and manufacturing plants during World War II; and the strategic significance of these sites made these areas a target for bombing. The Zetica Regional Unexploded Bomb Risk map for the Teesside-Durham-Stockton area classify the Unexploded Bomb risk (UXB) of SSI2 as being 'moderate'. This classification is derived based on a "bomb density of between 11 and 50 bombs per 1000 acres and that may contain potential WWII targets".

With reference to Section 3.2 (historical development), the initial iron/steelworks was not developed until the 1930's. However given the density of industrial sites within the immediate surrounding area during both the First and Second World Wars, it is recommended that further investigation be undertaken to determine the UXB risk on site.

3.9 Landfill

The EA interactive Landfill maps show that there are several active landfill sites within or in the vicinity of the site as summarised in Table 3.3.

Table 3.3 – Active Landfills

Name	**Approximate distance to site boundary and direction**	**Operator**	**Licence type**
Warrenby Landfill EAEPR\EA/EPR/KP3790ZE/V002	Approximately 300m south east of eastern boundary	Tata Steel UK Ltd	A04: Household, Commercial & Industrial Waste Landfill. Status - Modified
Bran Sands EAEPR\EA/EPR/MP3790ZW/V002	Approximately 850m south of southern site boundary	I C I Chemicals & Polymers Ltd	A02: Other Landfill site taking Special Waste. Status - Modified
B S Redcar Works EAEPR\EA/EPR/TP3390Z/A001	Approximately 1150m to the west of the western site boundary	Corus Construction & Industrial (British Steel Plc)	A07: Industrial waste Landfill (Factory Curtilage) Status: Closure

The mapping also shows the following historical landfill sites:

Table 3.3 – Historical Landfill sites

Name	**Approximate distance to site boundary and direction**	**Waste types**	**Dates**
Warrenby- Land adjacent to Redcar Blast Furnace	100m to the north	Inert and Industrial	Unknown

Table 3.3 – Historical Landfill sites

Name	Approximate distance to site boundary and direction	Waste types	Dates
Redcar Complex	Approximately 1100m south east of the eastern site boundary.	Not detailed	Unknown
Land North of York Road	Approximately 1100m to the east	Inert	13/07/82 to 09/10/85

3.10 Designations

On the basis of the MAGIC Website the following designations apply:

Teesmouth and Cleveland Coast Special Protection Area (SPA), South Gare and Coatham Sands Site of Special Scientific Interest (SSSI) and Teesmouth and Cleveland Coast Ramsar Site are located adjacent to the northern boundary of the site.

3.11 Potential Hazards and Permits

The hazards and permits that affect the site have been reviewed via the EA interactive website. Whilst no specific reference is made to the site area it is likely that some of the permits are registered to Steel House in site TS1. The TS1 Desk Study Report (2017)) should therefore be reviewed in conjunction with this report. Supplementary data is also held within the RCBC DSR 2016 and where available this data has also been referred to. The following hazards and permits are registered to this site:

Table 3.4- Hazards and Permits

Hazard/permit/ Licence/Incident Number	Approximate location	Comment
Control of Major Accidents Hazard Regulations 2015 (COMAH)		
COMAH Upper Tier Establishment, issued to SSI UK IL. Last inspection 29/06/2016.	Entire SSI site at Redcar, Cleveland and Lackenby, including SSI2.	Upper Tier classification upheld due to continued presence of large quantities of PAH on site, contained within the coke oven gas main. Drawing A119673 identifies the location of COMAH Substances located on site during the operation of the steelworks.
Licence		
Licence AO9684 - 1999	Licence registered to Steel House – Teesside Works	Release to air of various substances and Disposal to landfill of non-Special Waste 5t.
Licence AO9684 - 1998	Licence registered to Steel House – Teesside Works	Release to air of various substances and Disposal to landfill of non-Special Waste 5t.
Permitted Processes		

Table 3.4- Hazards and Permits

Hazard/permit/ Licence/Incident Number	**Approximate location**	**Comment**
EPR/JP3638HM consolidated permit amending and replacing EPR/JP3638HM and EPR/VP3737CF dated April 2013	Teesside Integrated Steelworks	Variation to permit the use of pulverised coal injection at the blast furnace
Discharge Consents - Note RCBC report numerous breaches during the permitting history		
W3 – Redcar Power Station	Emission to water Tees Bay at NZ56902700	After RCBC DSR 2016.
W4 – Redcar Blast Furnace Slag Quench Tank Overflow water	Soakaway to ground at NZ56662587	After RCBC DSR 2016
W6 – Redcar Coke Ovens Fire Fighting Water	Fire water soakaway to ground at NZ56172593	After RCBC DSR 2016
R1 – Redcar Coke ovens Effluent Treatment Plant	Emission to water - River Tees Estuary at NZ54702640	After RCBC DSR 2016 Emission breaches to water include Free Cyanide; Monohydric Phenol; Oils and Suspended solids

Geo-environmental and Contamination

4.1 Processes on site

4.1.1 Land raising

The development of the site has included historic land raising to enable the development of the site. Based on the available ground investigation data this is largely made up of slag waste associated with the historic iron works in the area.

4.1.2 Iron and Steel Works including Slag and Macadam Works (historical)

The former Ironworks/Steel works (pre 1970s) have been cleared from the site however, the potential for contamination associated with these process cannot be discounted. Many of the activities were potentially contaminative and which could include, refractory wastes, coking wastes, fuels and oils, slag wastes and asbestos.

4.1.3 Blast Furnace/Coking Works/By-Products and Power Station

The nature of the steel making is a complex and involves a number of process and supporting activities that have the potential to be contaminative. Within the site the processes included the manufacturing of coke from coal. This process involved the carbonisation of coal to high temperatures in an oxygen-deficient atmosphere in order to concentrate the carbon. A by-product of the process is the off gas which was collected and sent to the By-Products plant. This process removed tar, ammonia, phenol, naphthalene, light oil and sulphur.

The process of steel making included the charging of the blast furnace (one the largest in Europe) with processed iron ore together coke and fluxes, typically limestone. The operating temperature of the blast furnace was about 1,500°C which decomposed the limestone into calcium oxide. This subsequently reacted with impurities within the ore to form a liquid slag which was tapped off for subsequent disposal. Following the production of the iron this was refined to reduce the carbon content at the BOS facility located approximately 6km by rail to the south of the site.

The nature of the waste produced by the process included slag and flue dusts with the later associated with cyanide compounds and heavy metals. Mineral oils and hydrocarbons were used throughout the site with the gas holders and fuel storage facilities/By-Products plant being of particular note.

SSI UK RBF 2016 also report a material called ‘Ramming Paste’ (33tonnes) to be located on waste ground close to the fitting workshop. This is a reported carcinogen. The status of this material remains to be confirmed.

4.1.4 Coke Oven Gas Main

A by-product of the coke oven process is a high energy gas which, after quenching and treatment to remove impurities, was recycled and used to fuel boilers and furnaces elsewhere on the site. This was also pumped around the wider steelworks site. Coke Oven Gas is highly flammable and an energy rich fuel and was used in a wide variety of applications across a steelworks. Coke oven gas is toxic in its unburnt state consisting of mainly hydrogen (52%) and methane (32%) and approximately 5.5% of carbon monoxide. As part of the safety process following shut down the entire Coke Oven gas system at the Power Station was systematically purged of unburnt gas by the use of gaseous nitrogen and then venting it to atmosphere in a controlled manner (SSI UK RCO 2016).

Coke Oven gas is also a pyrophoric substance i.e. it will ignite spontaneously in air at or below 55°C without an ignition source being required. This did not pose a risk during service as there was no air present within the pipework. However, during periods of maintenance, there were reported numerous occasions where the COG mains have been opened, allowing air to enter, resulting in fires.

The pyrophoric materials are caused when internal corrosion takes place within the steel constructed gas mains caused by corrosive products in the gas. This results in the formation of iron sulphide, the pyrophoric material. Other products, such as naphthalene, are not pyrophoric but are flammable. Therefore, the self-ignition source of the iron sulphide will then ignite the naphthalene, resulting in an internal gas mains fire.

SSI UK RCO 2016 reports that the gas distribution systems on the entire site contain many hundreds of tonnes of flammable deposits, along with pyrophoric materials. If left unmanaged, there is a risk of air ingress resulting in spontaneous fires across the site. In addition the condensate pits located along the route of the gas main may represent areas of potential spillage/leakage.

SSI UK as part of the "making safe" programme, identified that the Coke Oven Gas Main will need cleaning out. This is undertaken by high pressure jetting with the waste captured for safe disposal. During operation of the plant this was a regular process and the waste was recycled. Following closure this will require careful management and off-site disposal. The status of any such cleaning is not known. The potential for asbestos gaskets to have been used within the pipe flanges should also be anticipated.

4.1.5 Sub Stations

Prior to the 1980s, Polychlorinated Biphenyls (PCBs) were routinely used as an insulator in electrical substations. Either during maintenance or disassembly, PCBs were often spilled on to the surrounding ground. The PCBs used in substations were generally of high viscosity and low leaching potential, so contamination can be expected to be localised.

While the exact dates of installation are unclear, it is reasonable to assume that some or all of the substations on site contained PCBs. The use of asbestos within substations is also considered likely.

4.1.6 Coal Stocks area

The majority of remaining coal stocks on site are understood to have been removed. Despite this some residual coal and coal dust is likely to remain within the Made Ground.

4.1.7 Ponding Area

The status of the disposal of waste and iron ore into the ponding areas is not known however excavation of the pond areas is understood to have been commenced (SSI UK RBF 2016). The purpose of this activity is not known.

4.1.8 Fuel Storage

Various fuel storage areas are present within the site area. The main fuel oil tanks were removed from service prior to SSI purchasing the site but the tanks were not fully emptied (SSI SR (2016). Potential contamination risks as a result of spillages and leakage associated with these facilities exist.

4.1.9 Offices and Stores

The site includes numerous offices and stores throughout the site that have the potential to have contained or contain potentially contaminative materials including asbestos, organic materials and various chemicals. It is considered likely that the majority of these materials will have been removed however asbestos containing materials within the structure of the buildings is likely to remain. The

potential for contamination as a result of spillage etc. cannot be discounted. In addition, potential biological hazards associated with rodent/avian activity may also be present.

4.1.10 Rail Lines

The site has been crossed historically by rail/tramways both historically and under the current site configuration. These routes represent a potential source of contamination as a result of spillage/loss of material.

4.1.11 Road/Haulage Routes

Internal infrastructure routes pass through the site linking to the adjacent areas and stockyards. These routes represent a potential source of contamination as a result of spillage.

4.1.12 CATS Pipeline and Pipe Crossings

The CATS carrying North Sea gas, runs along the eastern boundary of the site. Whilst unlikely to be contaminative, it is an extremely sensitive asset and worthy of note.

4.2 Summary of previous geo-environmental testing

As part of the Enviros (2004) ground investigation to establish baseline soil and groundwater conditions, a total of 58 trial pits and nine boreholes were constructed within the SSI2 site area. The results were assessed against Soil Guideline Values (SGV) derived from the now obsolete Dutch Intervention Values DIV), CLEA Industrial Guidance Limits and values derived for the site by Enviros a part of the 2004 Interpretative Report. For comparison, the results in Table 4.1 have been compared to current Land Quality Management (LQM) Suitable For Use Levels (S4UL) for a Commercial end use (where available) as this is understood to be the most likely end use for the site. Lead concentrations have been compared to the C4SL for Public Open Space (SP1010 – Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, Contaminated Land: Applications in Real Environments - CL:AIRE (2014). The following exceedances were noted as detailed in Table 4.1:

Table 4.1 – Exceedances of Soil Tier 1 Screening Criteria after Enviros 2004) and S4UL

Deteminand (Soil)	**Enviros 2004 Screening Level** ***[S4UL Commercial]***	**Power Plant** **17 Trial Pits, 2 Boreholes,** **38 samples primarily from Made Ground** **Number of Exceedances**	**Blast Furnace** **14 Trial Pits, 2 Boreholes** **22 samples primarily from Made Ground** **Number of Exceedances**	**Coke Ovens** **5 Trial Pits, 2 Boreholes** **11 samples primarily from Made Ground** **Number of Exceedances**	**By - Products** **22 Trial Pits, 3 Boreholes** **45 samples primarily from Made Ground** **Number of Exceedances**
pH	<5 or >10	17	9	7	21
Boron	3 mg/kg (ESV) ***[240000 mg/kg]***	- -	- -	- -	1 -
Copper	190 mg/kg (DIV) ***[68000 mg/kg]***	- -	- -	- -	2 -

Table 4.1 – Exceedances of Soil Tier 1 Screening Criteria after Enviros 2004) and S4UL

Deteminand (Soil)	**Enviros 2004 Screening Level** ***[S4UL Commercial]***	**Power Plant** **17 Trial Pits, 2 Boreholes,** **38 samples primarily from Made Ground** **Number of Exceedances**	**Blast Furnace** **14 Trial Pits, 2 Boreholes** **22 samples primarily from Made Ground** **Number of Exceedances**	**Coke Ovens** **5 Trial Pits, 2 Boreholes** **11 samples primarily from Made Ground** **Number of Exceedances**	**By - Products** **22 Trial Pits, 3 Boreholes** **45 samples primarily from Made Ground** **Number of Exceedances**
Polycyclic Aromatic Hydrocarbons (PAH)	40 mg/kg (DIV)	5	3	1	5
Total Petroleum Hydrocarbons (TPH)	5000 mg/kg (DIV)				2
Lead	750 mg/kg (CLEA) ***[750 mg/kg*]***		1		
Zinc	720 mg/kg (DIV) ***[73000 mg/kg]***	1	1		4
Acid Soluble Sulphate	1,000 mg/kg (ESV)	10	6	2	3
Water Soluble Sulphate	12,000 mg/kg	9	4	1	10
Total Sulphur	20000 mg/kg (ESV)				1

Notes

CLEA – Contaminated Land Exposure Assessment - Industrial Guidance Levels, DIV – Dutch Intervention Value, ESV – Enviros Screening Value

* C4SL

Only one round of groundwater testing was conducted on the nine groundwater boreholes and testing results were compared by Enviros to the UK Drinking Water Standards applicable at the date of the report. Widespread elevated concentrations of sulphate and cyanide were identified together with isolated heavy metal exceedances. In addition, total petroleum hydrocarbons were also identified across the site area.

The RCBC DSR 2016 includes data on monitoring of discharges from the Redcar Coke Ovens Effluent Treatment Plant (R1 – see Table 3.4). This monitoring confirmed exceedances of the Environmental Quality Standards for inland waters for most notably Benzo(a)Pyrene and Fluoranthene.

RCBC DSR 2016 also reviews data from 2001 supplied as part of a planning application by Corus. Within the general area of SSI2 there were reported exceedances of ammoniacal nitrogen, various metals, inorganic compounds and dioxins.

Asbestos containing materials are identified on site and include where identified Chrysotile (White) and Amosite (Brown Asbestos). Specific Asbestos Registers exist for the various buildings. The records however may not be complete.

4.3 Summary of Potential Contaminants

Based on the recent and historic site processes the potential contaminants are detailed in Table 4.2:

Table 4.2 – Potential Contaminants

Potential contaminant	**Process**									
	Made Ground	**Former Iron Works**	**Steelworks including power station and Coke works and By-Products pant**	**Sub Stations**	**Coke Oven Gas Main**	**Ponding Areas**	**Coal Stocks area**	**Fuel Storage**	**Rail Lines**	**Road**
Metals	√	√	√		√	√	√		√	√
Asbestos	√	√	√	√	√	√	√	√	√	√
PCB		√	√	√						
Organic Hydrocarbons	√	√	√		√			√	√	√
Inorganic compounds including Sulphides/sulphates/Carbonates	√	√	√		√	√	√		√	√

Preliminary Conceptual Site Model

5.1 General

In the UK the main legislation behind the contaminated land regime is Part 2A of the Environmental Protection Act 1990 (EPA) and the subsequent and updated Contaminated Land Statutory Guidance (2012). This provides a basis for identifying land that is considered to be unacceptable due to the risks posed by the presence of the contamination, and a mechanism by which sites can be determined as contaminated based on current risk.

However, the main aim of the planning regime with respect to contaminated land is to ensure that future risks posed by land contamination will not be unacceptable (as a minimum any site, following its development, should not be capable of being determined as contaminated under Part 2A). This philosophy is enshrined within the National Planning Policy Framework, 2012 (Paragraphs 120 and 121), which places the onus on the party undertaking the development to demonstrate that the proposed development does not constitute an unacceptable risk to either the human health of future site users or the surrounding environment.

The CLR11 Guidance is used to provide a consistent framework for the assessment and management of potential risks associated with contaminated land including sites assessed, managed and redeveloped under the planning regime. CLR11 requires that sites are evaluated on an individual / site specific basis, using a risk based approach. Risks are evaluated according to the site specific conceptual site model that defines the relationship between, sources of contamination, the receptors at risk of impact / exposure / harm and the pathways that link the sources and the receptors. For a risk to exist there needs to be a potential linkage between a source of contamination, a pathway and a receptor.

Sources and receptors have been established based on the findings of this Desk Study. Potential pathways have been based on reasonable scientific knowledge of contaminants properties and their behaviour in the ground.

A pollutant linkage does not exist unless a source can be linked by a pathway to a receptor; without any one of these elements, a linkage does not exist.

5.2 Potential Sources of Contamination On-site

Table 5.1 details the potential pollutant linages associated with the site.

Table 5.1 - Potential Sources of Contamination

Site feature	Contaminant group	Contaminant	Likelihood	
			Likely	Unlikely
Made Ground	Slag	Various metals /pH	√	
	Elevated pH		√	
	Soil gases	Carbon dioxide, methane hydrogen sulphide	√	
		Sulphides/Sulphates		
	Metals		√	
	Domestic Waste			√
	Sulphides/sulphates/Carbonates		√	

Site feature	Contaminant group	Contaminant	Likelihood	
			Likely	Unlikely
Tidal Flats /Glaciolacustrine deposits	Soil gases	Carbon dioxide, methane hydrogen sulphide	√	
Former Iron/steelworks, Slag & Macadam works/coke works Existing Blast Furnace/ Coke ovens/By-Products plant	Fuel and Oils	Diesel/Petrol	√	
	Transformer oils	PCB	√	
		Oil	√	
	Metals	Various metals	√	
	Asbestos	Chrysotile/Amosite	√	
	Other	Coal, coal tar, boiler ash, ammoniacal liquor, cyanide and sulphides/Sulphates	√	
		Flue Dust/coal dust	√	
Coke Oven Gas Main	Hydrocarbons	Various	√	
	Asbestos	Chrysotile/Amosite	√	
Sub Stations	Transformer oils	PCBs	√	
	Asbestos	Chrysotile/Amosite	√	
Coke Stocks / Ponding area	Slag	Various metals /pH	√	
	Fuel and Oils	Hydrocarbons	√	
	Other	Sulphides/Sulphates, pH	√	
Buildings and Maintenance Areas	Asbestos	Chrysotile/Amosite	√	
	Fuel and oil	Diesel, oil/grease	√	
Railway Lines	Slag	Various metals/pH	√	
	Asbestos	Chrysotile/Amosite	√	
	Fuel and oil	Diesel, oil/grease	√	
Highways	Fuel and oil	Diesel	√	
		Petrol	√	
		Oil and grease	√	
Fuel Storage Areas	Fuel and oil	Diesel	√	
		Petrol	√	
		Oil and grease	√	
	Asbestos	Chrysotile/Amosite	√	

5.3 Potential Pathways

Table 5.2 – Potential Pathways

No	Potential Pathway
1	Vertical migration through geological deposits
2	Surface water runoff
3	Migration via groundwater flows
4	Inhalation
5	Dermal contact

5.4 Potential Receptors

Table 5.3 – Potential Receptors

No	Potential Receptors
1	Human Health – Trespassers, Construction workers and site visitors
2	Human health - Future/End users of the site
3	Human Health - Site neighbours and public
4	Controlled water - Groundwater
5	Controlled water - Surface Water
6	Controlled water - Nearby estuary and sea
7	Air quality
8	Ecosystems
9	Construction materials

5.5 Potential pollutant linkages

Appendix D presents a comprehensive catalogue of the potential linkages between the identified site features, potential receptors and the pathways by which they may be connected. Those linkages which are considered to be plausible are summarised in Table 5.4 below. Where linkages are considered to be plausible, their severity, likelihood and risk (as used in Appendix D) are evaluated in accordance with the tables included in Appendix E.

Table 5.4 below presents an overview of the plausible pollutant linkages which may be present within the confines of the TS2 land parcel.

Table 5.4 - Plausible Pollutant Linkages

Site feature	Contaminant group	Contaminant/s	Pathway	Receptor	Risk
Made Ground	Metals	Slag	√	√	√
	Soil Gas	Elevated pH	√	√	√
		Metals	√	√	√
		Carbon dioxide, methane, hydrogen sulphide	√	√	√
Tidal Flats /Glaciolacustrine deposits	Soil gases	Carbon dioxide, methane, hydrogen sulphide	√	√	√
Former Ironworks, Slag & Macadam Works	Organics	Diesel/Petrol/oil/ coal tar	√	√	√
	Transformer oils	PCB	√	√	√
	Metals	Various metals	√	√	√
	Asbestos	Chrysotile/Amosite	√	√	√
	Other	Coal, boiler ash, Sulphates	√	√	√
Blast Furnace	Organics	Diesel/Petrol/lubricating oils	√	√	√
	Transformer oils	PCB	√	√	√
	Metals	Various metals	√	√	√
	Asbestos	Chrysotile/Amosite	√	√	√
	Other	Coal, boiler ash, Sulphates	√	√	√
Coke Works	Organics	Diesel/Petrol/lubricating oils/coal tars, ammoniacal liquor, solvents	√	√	√
	Metals	Various metals	√	√	√
	Asbestos	Chrysotile/Amosite	√	√	√
	Other	Coal, boiler ash, cyanide and Sulphates, PCBs	√	√	√
By-Products Plant	Organics	Diesel/Petrol/lubricating oils/coal tars, ammoniacal liquor, solvents	√	√	√
	Metals	Various metals	√	√	√
	Asbestos	Chrysotile/Amosite	√	√	√
	Other		√	√	√

Table 5.4 - Plausible Pollutant Linkages

Site feature	Contaminant group	Contaminant/s	Pathway	Receptor	Risk
		Coal, boiler ash, cyanide and Sulphates, PCBs			
Coke Oven Gas Main	Organics Asbestos Other	Various PAH's Chrysotile/Amosite Pyrophoric material including iron sulphide and	√ √ √	√ √ √	√ √ √
Sub Stations	Organics Other	PCBs Asbestos	√ √	√ √	√ √
Coal Stocks / Ponding area	Metals Other	Metal residues Asbestos/ash/ sulphates/sulphides	√ √	√ √	√ √
Buildings and Maintenance Areas	Organic Metals Other	Fuel/ oil/solvents Metal residues Asbestos/chemicals	√ √ √	√ √ √	√ √ √
Fuel Storage Areas	Organic	Fuel and oil	√	√	√
Railway Lines	Organic Metals Other	Fuel and oil Metal residues Asbestos/ash	√ √ √	√ √ √	√ √ √
Site roads/car parks	Organic	Diesel Petrol Oil and grease	√ √ √	√ √ √	√ √ √

Geotechnical constraints and potential opportunities

6.1 Introduction

In addition to the geoenvironmental considerations, the site and its historic uses pose a number of potential geotechnical constraints to both construction and development of the site, and to ground investigation.

6.2 Ground conditions

6.2.1 Made Ground

Engineering fills which contain a significant proportion of certain types of slag may pose a risk to future buildings and structures due to their potential to exhibit volumetric instability (i.e. the potential to expand) resulting in differential ground movements. Subject to the nature of the fill proved on site determination of the properties of these materials will be required. In addition slag bearing materials can contain so called 'slag skulls' which are fused slag concretions that are extremely difficult to excavate and break up. The potential for fused layers of slag should also be considered likely.

Slag can also weather resulting in the creation of tufa (calcium hydroxide and calcium carbonate precipitates). This can be mobilised in surface and groundwater leading to damage to drainage infrastructure and unsightly deposits in watercourses.

Material containing slag may be "conditioned", by its excavation, crushing to a suitable grading, and subsequent processing by a long-term programme of hydrating and turning the material. The purpose of such a process would be to homogenise the materials, and to promote the occurrence of expansive behaviours within the material. The material would be subsequently used as an engineering fill, being placed and compacted in layers.

6.2.2 Compressible Soils

The site is underlain by Tidal Flat deposits that contain peat layers. As a result these materials are highly susceptible to compression. In addition, the nature of the underlying solid geology is composed of weathered clay and Clay. Detailed consideration to the founding option will be required subject to the nature of any proposed development.

6.2.3 Obstructions

Buried obstructions associated with the former Iron works/Steel works and the associated buildings together with buried obstructions in other areas cannot be discounted. In addition, redundant services lines and rail lines may represent constraints and possible contamination risks. The former South Gare Breakwater represents a significant obstruction within the site.

6.2.4 Existing foundations

Existing bridge structures, redundant building foundations, walls and hardstandings are present on site many of these are likely to have been piled. In addition the potential for basements structures associated with the site processes is high. The makeup of these foundations is unknown but could include significant structures.

6.2.5 Outfall Tunnel

The outfall tunnel is a significant feature that is linked to a number of shafts along its route. Specialist consideration will be required with respect to the decommissioning of this feature.

6.2.6 Ground aggressivity

Given the nature of the site buried concrete is likely to be susceptible to sulphate attack that can lead to expansion/softening of concrete.

6.3 Future geotechnical considerations

The potential for expansive slag on site cannot be discounted and specialist laboratory testing would be required to determine this risk. In addition, fused slag can also pose a significant development risk if present as fused layers or as slag skulls. Further ground investigation is required to determine the geo-environmental and geotechnical properties of the Made Ground and underlying superficial deposits. This will also determine the thickness of the Made Ground, the groundwater conditions beneath the site; and allow parameter to be derived for design.

The possible presence of ground gas should also be investigated. Both gas generated from the natural decay of organic matter within the superficial deposits and that associated with solvents, hydrocarbons and organic compounds used and produced on site.

Site development considerations

7.1 Introduction

Table 7.1 summarises the main geotechnical and geoenvironmental risks highlighted by the study and the requirements of future researches/investigations. The historic and previous developments at the site represent significant constraints. The possibility of additional contamination of the surface taking place as a result of the demolitions works is also considered likely and will require appropriate management:

Table 7.1 – Site Development Considerations

Consideration	**Detail**	**Possible mitigation measures**
Geotechnical		
Compressible Soils	Failure of foundation as a result of bearing failure or settlement	Ground investigation and associated geotechnical laboratory testing in order to characterise the nature of the near surface materials
Potentially expansive slag	Potential to disrupt foundations/hard standings as a result of expansion	Assessment of the potential expansive properties of the Made Ground via specialist testing. Consider removal of impacted materials to a less sensitive area, such as an areas of soft landscaping. Consider options to process slag-bearing Made Ground in order to produce a homogenised material for re-use. Consider possible engineering solutions including protecting piled foundations by the use of non-compressible sleeves around piles.
Variable thickness of Made Ground	Potential for differential ground movements as a result of the variability of materials and their existing state of compaction	Ground investigation and associated geotechnical laboratory testing in order to characterise the nature of the near surface materials. If suitable excavate and re-lay materials in controlled layers to an engineering specification.
Obstructions/deep foundations/shafts/basements	Potential for additional construction costs delays to programme	Further researches in order to try to determine the presence of buried obstructions. Trial ground clearance/investigation
Shallow Groundwater	Groundwater conditions likely to be shallow.	Ground investigation to establish groundwater elevation via

Table 7.1 – Site Development Considerations

Consideration	Detail	Possible mitigation measures
		installation of piezometer monitoring wells.
Geo-environmental		
Asbestos in soil	Potential for unanticipated disposal costs	Include asbestos testing and if identified quantification laboratory testing suites. Consider options for impacted materials to be isolated beneath foundations, core of landscaping features etc subject to agreement with the local authority and recording the locations in the Health and Safety file.
Ground Gas from both natural and Made Ground source	Potential for ground gas to impact on future development	Ground investigation to establish ground gas regime via installation of combined gas/groundwater monitoring wells.
Human Health and Ecological Impacts	Residual contamination in particular organic contamination risks on the groundwater environment	Ground investigation to establish the risk to human health and the environment
Slag	Potential to cause deposits of tufa, leading to damage to drainage infrastructure and unsightly deposits in watercourses	Further investigation to confirm the presence of slag. Consider use of the slag in the earthwork, e.g. distal from watercourses.

Proposals for further investigation

8.1 Introduction

Development proposals for SSI2 will need to consider the options for the potential reuse of the site given that there is a requirement for significant investment to demolish the site and deal with residual contamination risks.

Based on the preliminary risk evaluation and the Site Development Considerations, the following proposals for further studies/investigations are presented:

8.2 Desk-based studies

Undertake a detailed review and schedule of existing structures on the site in order to aid demolition studies.

Delineation of subsurface structures and commission inspections to assess condition/contamination risk.

Further details on the Coke Oven Gas Pipeline decommissioning and implications.

Review of Asbestos Registers for the site and commissioning (if not already available) demolition surveys.

Commission a UXO desk study for the overall steelworks site area.

8.3 Intrusive investigation

Intrusive investigations should be conducted on a phased approach with preliminary investigations providing baseline conditions prior to exploratory ground investigations to provide focussed development option investigations. As a precursor to any ground investigation a detailed topographic survey of the site should be acquired. In addition, all service locations should be physically identified on site prior to undertaking investigations in a specific area. It should be noted that due to the presence of slag on site that the ability of a cable percussive rig to drill through this material may be restricted. The possibility that an excavator (with pecker attachment) may be required to make initial section of the borehole cannot be discounted.

Table 8.1 – Intrusive Investigations

Area	Location	Proposed Investigation	Comments
A	Coke Oven	15No. Trial pits to 5mbgl 2No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Breaking out of hardstanding's and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required

Table 8.1 – Intrusive Investigations

Area	Location	Proposed Investigation	Comments
B	By Products Plant	20No. Trial pits to 5mbgl 5No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Four boreholes to be targeted near the Coke Oven Gas Holder and Blast Furnace Gas Holders. Breaking out of hardstanding's and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required
C	Coke Stock Area	10No. Trial pits to 5mbgl 1No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Breaking out of hardstanding's and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required
D	Liquid Nitrogen Storage Area	5No. Trial pits to 5mbgl 1No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Breaking out of hardstanding's and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required
E	Fuel Oil Storage	4No. Trial pits to 5mbgl 1No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock	Locations to be located subject to access and services. One borehole to be targeted north of fuel tanks.

Table 8.1 – Intrusive Investigations

Area	Location	Proposed Investigation	Comments
		Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Breaking out of hardstanding's and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required.
F	Power Plant	6No. Trial pits to 5mbgl 1No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Ground investigation positions to be restricted to the periphery of the main building. Breaking out of hardstanding's and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required
G	Blast Furnace	25No. Trial pits to 5mbgl 5No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Ground investigation positions to be restricted to the periphery of the main building. Breaking out of hardstanding's and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required
H	Blast Furnace Stockhouse	10No. Trial pits to 5mbgl 1No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing.	Locations to be located subject to access and services. Ground investigation positions to be restricted to the periphery of the main building.

Table 8.1 – Intrusive Investigations

Area	Location	Proposed Investigation	Comments
		Groundwater monitoring piezometers within boreholes	Breaking out of hardstandings and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required
I	Main Workshops/Stores	10No. Trial pits to 5mbgl 2No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Ground investigation positions to be restricted to the periphery of the main building. Breaking out of hardstandings and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required
J	Disposal Area	15No. Trial pits to 5mbgl 5No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Breaking out of hardstandings, buried foundations and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required
K	Ponding Area	12No. Trial pits to 5mbgl 5No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Breaking out of hardstandings and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required

Table 8.1 – Intrusive Investigations

Area	Location	Proposed Investigation	Comments
L	Historical Steel and Processing Plant	60No. Trial pits to 5mbgl 7 No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Breaking out of hardstandings, buried foundations and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required
M	Other	100No. Trial pits to 5mbgl 8 No. Rotary corded boreholes within cable percussive follow on to rockhead plus 10m in rock Samples of geo-environmental and geotechnical testing. Groundwater monitoring piezometers within boreholes	Locations to be located subject to access and services. Breaking out of hardstanding's, buried foundations and possible fused slag layers cannot be discounted. Pre-excavation of boreholes locations likely to be required

Appendix A - Borehole layout plans RGEN136 and X57642.

Appendix B - CORUS UK Ltd - Soil and Groundwater Baseline Characterisation Study Teesside Works June 2004 – Factual Ground Investigation Data

Appendix C – SSI UK Reports

Appendix C1	SSI UK - Report into the condition of Redcar Coke Ovens in preparation for keeping it safe 2016
Appendix C2	SSI UK - Report into the condition of Redcar Power Station in preparation for keeping it safe 2016.
Appendix C3	SSI UK - Report into the condition of Redcar Blast Furnace in preparation for keeping it safe 2016.
Appendix C4	SSI UK - Report into the condition of the Non-Aligned Buildings in preparation for keeping it safe 2016.
Appendix C5	SSI UK - Report into the condition of the Workshop Buildings and Structures in preparation for keeping it safe 2016.
Appendix C6	SSI UK - Report into the condition of the Services in preparation for keeping it safe 2016.

Appendix D – Pollutant linkages

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
PCBs	Former Iron/Steelworks Electrical Substations Existing Steelworks Substations	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	x				Based on the age of these works sites PCBs will have been used within sub-stations and transformers.
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	√	Medium	Moderate	Moderate	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate	
			Air quality	x				
			Ecosystems	√	Severe	Moderate	High Risk	PCB's can readily persist within the environment
			Construction materials	x				
		Surface water runoff	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	√	Medium	Moderate	Moderate	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate	
			Air quality	x				
			Ecosystems	√	Severe	Low	Moderate Risk	PCB's can readily persist within the environment

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
			Construction materials	x				
		Migration via groundwater flows	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	√	Medium	Moderate	Moderate	
			Controlled water - Groundwater	√	Medium	Moderate	Moderate	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate	
			Air quality	x				
			Ecosystems	√	Medium	Moderate	Moderate	
			Construction materials	x				
		Inhalation	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
		Dermal contact	Human Health - Construction workers and site visitors	√	Medium	Moderate	Moderate	
			Human health - Future/End users of the site	√	Medium	Low	Moderate/ Low	
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				
Ground gas	Made Ground Superficial Deposits	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	√	Medium	Moderate	Moderate	
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	√	Medium	Low	Moderate/ Low	
			Ecosystems	x				
			Construction materials	x				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
		Surface water runoff	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				
		Migration via groundwater flows	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
		Inhalation	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	√	Medium	Low	Moderate/ Low	
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				
		Dermal contact	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
Organic and inorganic compounds	Former Ironworks and associated buildings including Slag and Macadam works and potential coking works structures. Current layout including Blast Furnace Coke Ovens By-Products Plant Coke Oven Gas Main Fuel Storage areas Maintenance works shops Railway lines Road/Car parks Made Ground	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	x				Potentail for leakage of hydrocarbons from historic and current fuel storage and transfer network, coke works and By-Products area. Leakage of Coke Oven Gas deposits such as Naphthalene.
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Low	Moderate/ Low	
			Air quality	x				
			Ecosystems	√	Medium	Low	Moderate/ Low	
			Construction materials	x				
		Surface water runoff	Human Health - Construction workers and site visitors	√	Medium	Low	Moderate/ Low	
			Human health - Future/End users of the site	√	Medium	Low	Moderate/ Low	
			Human Health - Site neighbours and public	√	Mild	Low	Low	
			Controlled water - Groundwater	√	Medium	Moderate	Moderate	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate	
			Air quality	x				
			Ecosystems	√	Medium	Moderate	Moderate	
			Construction materials	√	Medium	Low	Moderate/ Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
		Migration via groundwater flows	Human Health - Construction workers and site visitors	√	Medium	Low	Moderate/ Low	
			Human health - Future/End users of the site	√	Medium	Low	Moderate/ Low	
			Human Health - Site neighbours and public	√	Mild	Moderate	Moderate/ Low	
			Controlled water - Groundwater	√	Medium	Moderate	Moderate	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate	
			Air quality	x				
			Ecosystems	√	Medium	Moderate	Moderate	
			Construction materials	√	Medium	Moderate	Moderate	
		Inhalation	Human Health - Construction workers and site visitors	√	Medium	Moderate	Moderate	Potentail for volatile organic compounds from Coke/By-Products areas/fuel storage areas
			Human health - Future/End users of the site	√	Medium	Moderate	Moderate	
			Human Health - Site neighbours and public	√	Mild	Moderate	Moderate/ Low	Off-site disposal requires careful management with respect to potential spread of contaminants
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
			Construction materials	x				
		Dermal contact	Human Health - Construction workers and site visitors	√	Medium	Moderate	Moderate	
			Human health - Future/End users of the site	√	Medium	Moderate	Moderate	
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				
Asbestos	Former Ironworks and associated buildings including Slag and Macadam works and potential coking works structures. Current layout including Blast Furnace Coke Ovens By-Products Plant	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
	Coke Oven Gas Main Fuel Storage areas Maintenance workshops Railway lines Road/Car parks Made Ground Pipe flanges	Surface water runoff	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				
		Migration via groundwater flows	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
		Inhalation	Human Health - Construction workers and site visitors	√	Medium	High	High Risk	Presence of asbestos assumed given the age of these works and the hot work nature of the associated pipework. Any asbestos will be in building rubble, within building/construction fabric, As such those at greatest risk are perceived to be demolition/Construction Workers
			Human health - Future/End users of the site	√	Medium	High	High Risk	
			Human Health - Site neighbours and public	√	Medium	Low	Moderate/ Low	
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	√	Medium	Low	Moderate/ Low	
			Ecosystems	x				
			Construction materials	x				
		Dermal contact	Human Health - Construction workers and site visitors	√	Medium	Low	Moderate/ Low	
			Human health - Future/End users of the site	√	Medium	Low	Moderate/ Low	
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
Elevated pH	Made Ground associated with the Former Iron/steel works and existing layout	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	√	Minor	Low	Very Low Risk	
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	√	Minor	Unlikely	Very Low Risk	
			Controlled water - Groundwater	√	Medium	Moderate	Moderate Risk	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate Risk	
			Air quality	X				
			Ecosystems	√	Medium	Low	Moderate/Low Risk	
			Construction materials	√	Mild	Moderate	Moderate/ Low Risk	
		Surface water runoff	Human Health - Construction workers and site visitors	√	Minor	Low	Very Low Risk	
			Human health - Future/End users of the site	√	Minor	Low	Very Low Risk	
			Human Health - Site neighbours and public	√	Minor	Low	Very Low Risk	
			Controlled water - Groundwater	√	Medium	Moderate	Moderate Risk	
			Controlled water - Surface Water	√	Medium	Moderate	Moderate	
			Air quality	X				
			Ecosystems	√	Medium	Low	Moderate/Low Risk	
			Construction materials	√	Mild	Moderate	Moderate/ Low Risk	
		Migration via groundwater flows	Human Health - Construction workers and site visitors	√	Minor	Unlikely	Very Low Risk	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	√	Minor	Unlikely	Very Low Risk	
			Controlled water - Groundwater	√	Minor	Unlikely	Very Low Risk	
			Controlled water - Surface Water	√	Minor	Unlikely	Very Low Risk	
			Air quality	X				
			Ecosystems	X				
			Construction materials	√	Mild	Low	Low Risk	
		Inhalation	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	X				
		Dermal contact	Human Health - Construction workers and site visitors	√	Medium	Moderate	Moderate	
			Human health - Future/End users of the site	√	Medium	Moderate	Moderate	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	√	Mild	Moderate	Moderate/ Low	
Metals	Former Ironworks and associated buildings including slag and Macadam works and potential coking works structures. Current layout including Blast Furnace Coke Ovens By-Products Plant Coke Oven Gas Main Fuel Storage areas Railway lines Road/Car parks	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	√	Mild	Moderate	Moderate/ Low	
			Controlled water - Surface Water	√	Mild	Moderate	Moderate/ Low	
			Air quality	x				
			Ecosystems	√	Mild	Moderate	Moderate/ Low	
			Construction materials					
		Surface water runoff	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Low	Moderate/ Low	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
	Made Ground		Air quality	x				
			Ecosystems	√	Medium	Low	Moderate/ Low	
			Construction materials	x				
		Migration via groundwater flows	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	√	Medium	Low	Moderate/ Low	
			Controlled water - Surface Water	√	Medium	Low	Moderate/ Low	
			Air quality	x				
			Ecosystems	√	Medium	Low	Moderate/ Low	
			Construction materials	x				
		Inhalation	Human Health - Construction workers and site visitors	√	Medium	Moderate	Moderate	Potentail for flue dust and coal/coke works dusts to be disposed of within the site area cannot be discounted. In addition, residual dust deposition could take place during demolition.
			Human health - Future/End users of the site	√	Medium	Moderate	Moderate	
			Human Health - Site neighbours and public	√	Mild	Moderate	Moderate/Low	Off-site disposal requires careful management with respect to potential spread of contaminants

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				
		Dermal contact	Human Health - Construction workers and site visitors	√	Medium	Moderate	Moderate	
			Human health - Future/End users of the site	√	Medium	Moderate	Moderate	
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	√	Medium	Moderate	Moderate	
Sulphides/ Sulphates	Made Ground associated with the Former Iron/steel works and existing layout	Vertical migration through geological deposits	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Mild	Moderate	Moderate/Low Risk	
			Controlled water - Surface Water	√	Mild	Moderate	Moderate/Low Risk	
			Air quality	X				

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
			Ecosystems	√	Medium	Moderate	Moderate Risk	
			Construction materials	√	Mild	High	Moderate Risk	
		Surface water runoff	Human Health - Construction workers and site visitors	X				Potential risk via Made Ground, Coke oven Gas residue
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Mild	Moderate	Moderate/Low Risk	
			Controlled water - Surface Water	√	Mild	Moderate	Moderate/Low Risk	
			Air quality	X				
			Ecosystems	√	Medium	Moderate	Moderate Risk	
			Construction materials	√	Mild	High	Moderate Risk	
		Migration via groundwater flows	Human Health - Construction workers and site visitors	X				
			Human health - Future/End users of the site	X				
			Human Health - Site neighbours and public	X				
			Controlled water - Groundwater	√	Mild	Moderate	Moderate/Low Risk	
			Controlled water - Surface Water	√	Mild	Moderate	Moderate/Low Risk	
			Air quality	X				
			Ecosystems	√	Medium	Moderate	Moderate Risk	

Source		Pathway	Receptor	Plausible	Initial assessment			Comment/data gap
Contaminant	**Site feature**				**Consequence**	**Likelihood (Probability)**	**Risk Evaluation**	
			Construction materials	√	Mild	High	Moderate Risk	
		Inhalation	Human Health - Construction workers and site visitors	x				
			Human health - Future/End users of the site	x				
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	X				
		Dermal contact	Human Health - Construction workers and site visitors	√	Medium	Moderate	Moderate	
			Human health - Future/End users of the site	√	Medium	Moderate	Moderate	
			Human Health - Site neighbours and public	x				
			Controlled water - Groundwater	x				
			Controlled water - Surface Water	x				
			Air quality	x				
			Ecosystems	x				
			Construction materials	x				

Appendix E –Risk Classification

Classification of Consequence

Classification	Definition	Examples
Severe	Short term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health ("significant harm" as defined in the DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem. (note: the definitions of ecological systems within Circular on Contaminated Land, DETR , 2000).	Concentrations of a contaminant from site exceed the generic, or site specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to buildings/structures and crops ("significant harm" as defined in the Draft Circular on Contaminated Land, DETR, 2000). Damage to sensitive buildings/structures or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).

Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as Personal Protective Clothing, etc). Easily repairable effects of damage to buildings/structures.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discolouration of concrete.

Classification of Likelihood

Classification	**Definition**
High	There is a pollution linkage and an event which would either appear very likely in the short term and almost inevitable over the long term, or, there is evidence at the receptor of harm or
Moderate	There is a pollution linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Risk evaluation of Consequence against Likelihood

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Likelihood	**High**	Very High Risk	High Risk	Moderate Risk	Moderate/ Low Risk
	Moderate	High Risk	Moderate Risk	Moderate/ Low Risk	Low Risk
	Low	Moderate Risk	Moderate/ Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/ Low Risk	Low Risk	Very Low Risk	Very Low Risk

Figures

Figure 1 – Site Location Plan

N

COATHAM MARSHES
(SSSI)

RBT

SSI 2

SSI 1

BRAN
SANDS
LAGOON

EX-ICI
LANDFILL

NWL BRAN SANDS
TREATMENT
PLANT

TS 2

TS 1

PD PORTS

TEES DOCK

BOC
PLANT

BRITISH
STEEL

TS 4

LANDFILL
ZONE

SSI
SLEMS

SSI
TIP

IMPETUS
TIP

PD
PORTS

SSI 3

TS 3

SOUTH TEES
FREIGHT
PARK

KEY

SSI 2 SITE PLAN

Rev	By	Chkd	Apprvd	Date	Description
-	-	-	-	-	-

Client

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Project

SSI REDCAR

Drawing

SSI 2
LOCATION PLAN

Drawn by: JT	Date: 10/05/2017
Checked by: RK	Date: 15/06/2017
Approved by: IDK	Date: 15/06/2017

Drawing No.

FIGURE 1

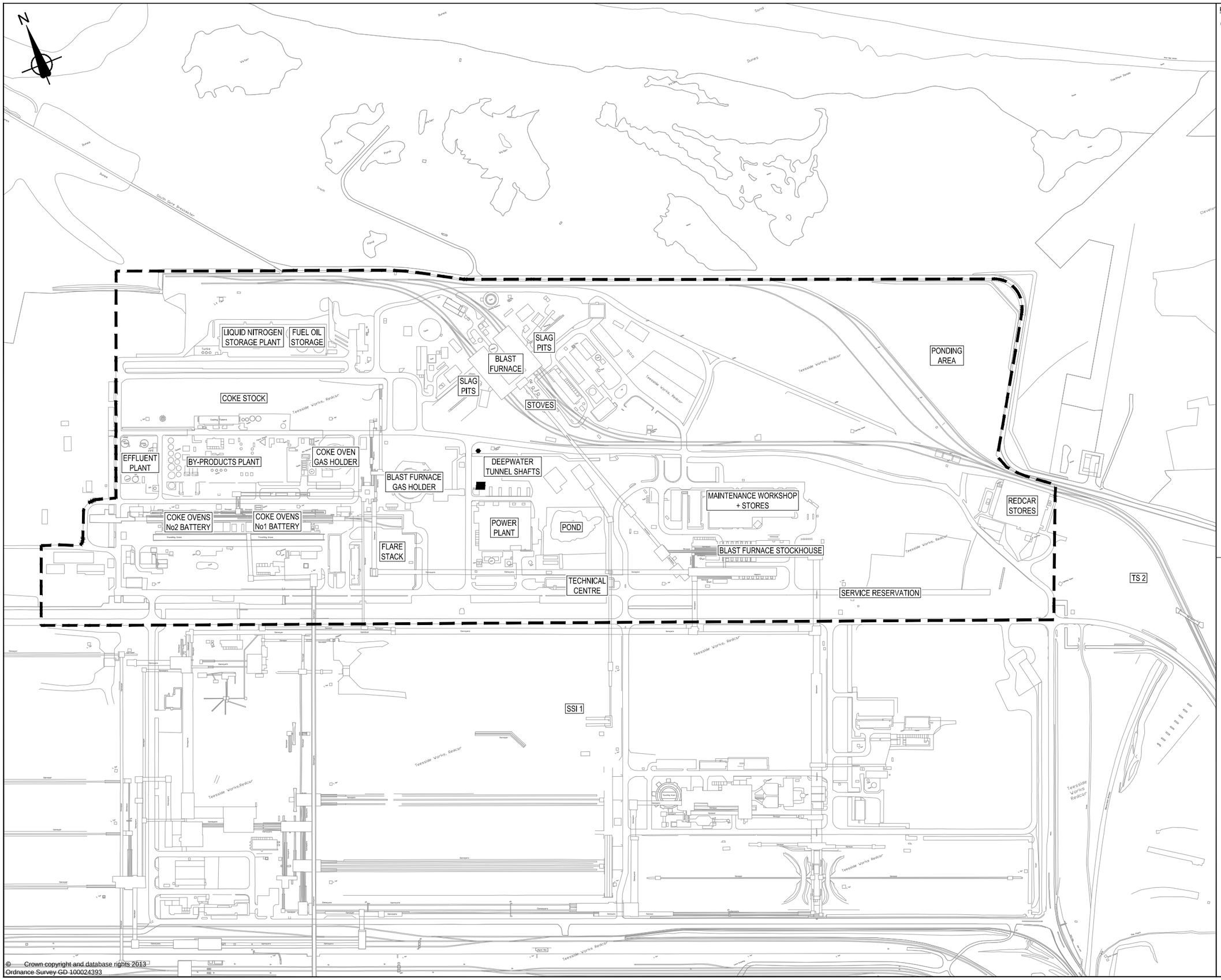
Revision

-

Drawing Scale: 1:12500 @ A1; 1:25000 @A3

Drawing file path & name:
Xreference file path:
User and Plot date:

Figure 2 – Site Setting



KEY

SSI 2 SITE AREA

-	-	-	-	-	-
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SSI 2
SITE SETTING

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Approved by: IDK	Date: 15/06/2017

Drawing No.

FIGURE 2

Revision

-

Drawing Scale: 1:3000 @ A1; 1:6000 @A3

Drawing file path & name:
Xreference file path
User defined field

Figure 3 – Historical Exploratory Hole Location Plan

N

LIQUID NITROGEN STORAGE PLANT

SOUTH GARE BREAKWATER

FUEL OIL STORAGE

BLAST FURNACE

SLAG + TAR MACADAM WORKS1929

SLAG + TAR MACADAM WORKS1929

MAIN WORKSHOPS/ STORES

DISPOSAL AREA

PONDING AREA

COKE STOCK AREA

STEEL PLANT

COATHAM IRON WORKS

BY-PRODUCTS PLANT

POWER PLANT

COKE OVENS

BLAST FURNACE STOCKHOUSE

COIL PROCESSING PLANT

MAIN WORKSHOPS/ STORES

SSI 1

KEY

- SSI 2 SITE PLAN
- HISTORICAL TANKS
- HISTORICAL RAIL TRACKS
- HISTORICAL BUILDING FOOTPRINTS
- SOUTH GARE BREAKWATER

Rev.	By	Chkd	Apprvd	Date	Description
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SSI 2
HISTORICAL SITE LAYOUT

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Approved by: IDK	Date: 15/06/2017

Drawing No.

FIGURE 3

Revision

-

Drawing Scale: 1:3000 @ A1; 1:6000 @A3

Drawing file path & name :
X:\reference file path\
User and Plot Date

Figure 4 – Historical Site Layout

N

SSI 2 AREA BOUNDARY

SSI 2 AREA BOUNDARY

SSI 1

COKE/ORE
66KV SUBSTATION

POWER STATION
66KV SUBSTATION

PELLET/SINTER
66KV SUBSTATION

COG MAIN

SS

NOTES

1. INDICATIVE ONLY.

KEY

- SSI 2 Site Area
- BT Openreach Underground
- BOC Oxygen Pipeline
- BOC Nitrogen Pipeline
- Supply Nitrogen Pipeline
- CATS Pipeline
- COG MAIN Coke Oven Gas Main Above Ground
- Fibre Optic Cables
- Portable Water Main
- Industrial Water Main
- Blast Furnace Gas Main
- Estuary Water Main
- GAS BREAGH 20" High Pressure Gas Pipeline
- FO Fuel Oil Pipeline
- Deepwater Tunnel
- SS 11kv Substations
- Service Reservations - HV Cable Routes

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Drawing

SSI 2
EXISTING UTILITIES

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Drawing No.

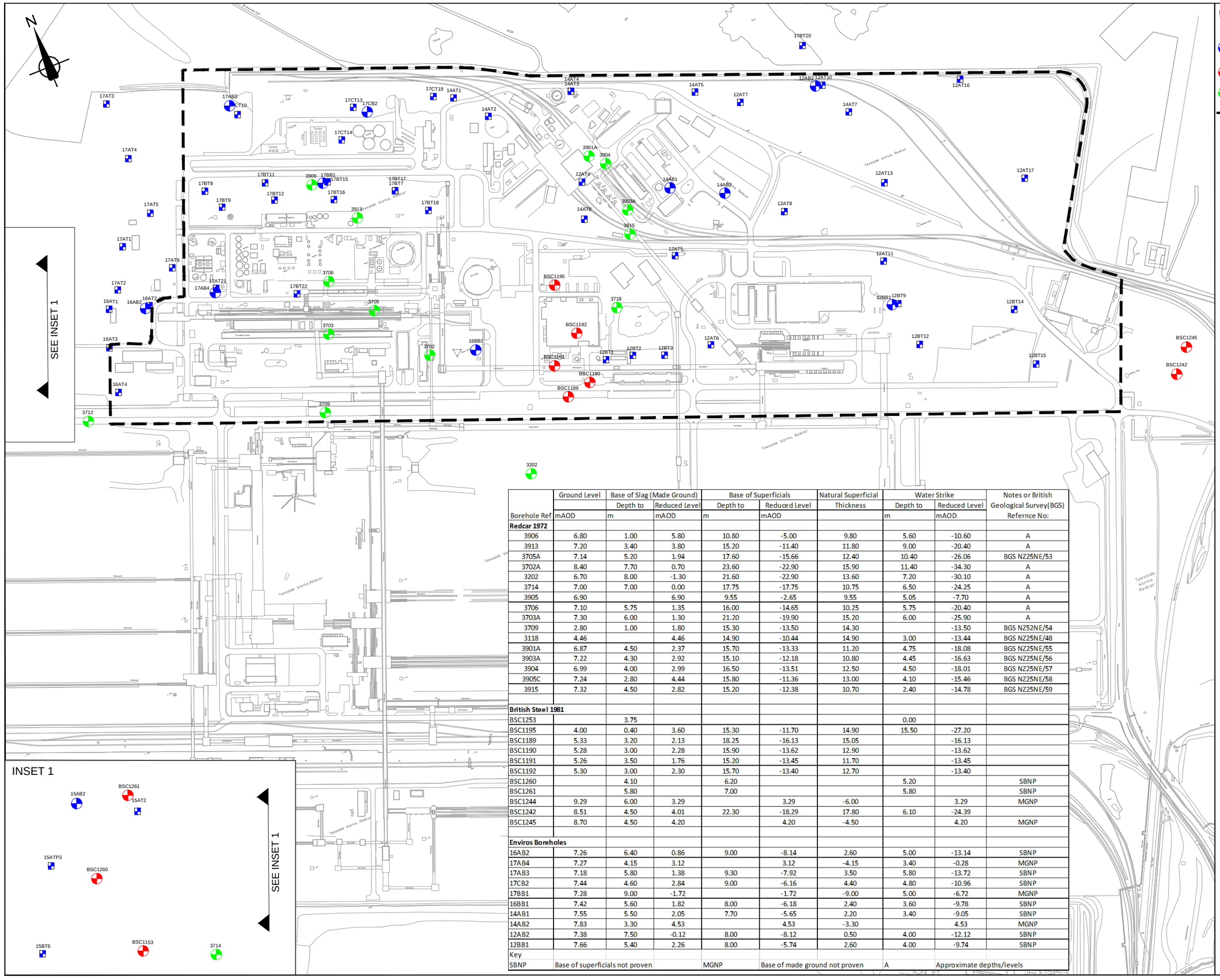
FIGURE 4

Revision -

Drawing Scale: 1:3000 @ A1; 1:6000 @A3

Drawing File path & name:
Xreference file path
User defined field

Figure 5 – Existing Utilities Plan



KEY

- 2004 TRIAL PITS FROM ENVIROS SOIL & GROUND WATER STUDY REPORT
- 2004 BOREHOLES FROM ENVIROS SOIL & GROUND WATER STUDY REPORT
- APPROXIMATE LOCATION OF BRITISH STEEL BOREHOLES 1981
- APPROXIMATE LOCATION OF REDCAR STEELWORKS BOREHOLES 1972 FROM PLAN RGEN186
- SSI 2 SITE AREA

	Ground Level	Base of Slag (Made Ground)		Base of Superficials		Natural Superficial	Water Strike		Notes or British
		Depth to	Reduced Level	Depth to	Reduced Level	Thickness	Depth to	Reduced Level	Geological Survey(BGS)
Borehole Ref	mAOD	m	mAOD	m	mAOD		m	mAOD	Refernce No:
Redcar 1972									
3906	6.80	1.00	5.80	10.80	-5.00	9.80	5.60	-10.60	A
3913	7.20	3.40	3.80	15.20	-11.40	11.80	9.00	-20.40	A
3705A	7.14	5.20	1.94	17.60	-15.66	12.40	10.40	-26.06	BGS NZ25NE/53
3702A	8.40	7.70	0.70	23.60	-22.90	15.90	11.40	-34.30	A
3202	6.70	8.00	-1.30	21.60	-22.90	13.60	7.20	-30.10	A
3714	7.00	7.00	0.00	17.75	-17.75	10.75	6.50	-24.25	A
3905	6.90		6.90	9.55	-2.65	9.55	5.05	-7.70	A
3706	7.10	5.75	1.35	16.00	-14.65	10.25	5.75	-20.40	A
3703A	7.30	6.00	1.30	21.20	-19.90	15.20	6.00	-25.90	A
3709	2.80	1.00	1.80	15.30	-13.50	14.30		-13.50	BGS NZ52NE/54
3118	4.46		4.46	14.90	-10.44	14.90	3.00	-13.44	BGS NZ25NE/48
3901A	6.87	4.50	2.37	15.70	-13.33	11.20	4.75	-18.08	BGS NZ25NE/55
3903A	7.22	4.30	2.92	15.10	-12.18	10.80	4.45	-16.63	BGS NZ25NE/56
3904	6.99	4.00	2.99	16.50	-13.51	12.50	4.50	-18.01	BGS NZ25NE/57
3905C	7.24	2.80	4.44	15.80	-11.36	13.00	4.10	-15.46	BGS NZ25NE/58
3915	7.32	4.50	2.82	15.20	-12.38	10.70	2.40	-14.78	BGS NZ25NE/59
British Steel 1981									
BSC1253		3.75					0.00		
BSC1195	4.00	0.40	3.60	15.30	-11.70	14.90	15.50	-27.20	
BSC1189	5.33	3.20	2.13	18.25	-16.13	15.05		-16.13	
BSC1190	5.28	3.00	2.28	15.90	-13.62	12.90		-13.62	
BSC1191	5.26	3.50	1.76	15.20	-13.45	11.70		-13.45	
BSC1192	5.30	3.00	2.30	15.70	-13.40	12.70		-13.40	
BSC1260		4.10		6.20			5.20		SBNP
BSC1261		5.80		7.00			5.80		SBNP
BSC1244	9.29	6.00	3.29		3.29	-6.00		3.29	MGNP
BSC1242	8.51	4.50	4.01	22.30	-18.29	17.80	6.10	-24.39	
BSC1245	8.70	4.50	4.20		4.20	-4.50		4.20	MGNP
Enviros Boreholes									
16AB2	7.26	6.40	0.86	9.00	-8.14	2.60	5.00	-13.14	SBNP
17AB4	7.27	4.15	3.12		3.12	-4.15	3.40	-0.28	MGNP
17AB3	7.18	5.80	1.38	9.30	-7.92	3.50	5.80	-13.72	SBNP
17CB2	7.44	4.60	2.84	9.00	-6.16	4.40	4.80	-10.96	SBNP
17BB1	7.28	9.00	-1.72		-1.72	-9.00	5.00	-6.72	MGNP
16BB1	7.42	5.60	1.82	8.00	-6.18	2.40	3.60	-9.78	SBNP
14AB1	7.55	5.50	2.05	7.70	-5.65	2.20	3.40	-9.05	SBNP
14AB2	7.83	3.30	4.53		4.53	-3.30		4.53	MGNP
12AB2	7.38	7.50	-0.12	8.00	-8.12	0.50	4.00	-12.12	SBNP
12BB1	7.66	5.40	2.26	8.00	-5.74	2.60	4.00	-9.74	SBNP
Key									
SBNP	Base of superficials not proven			MGNP	Base of made ground not proven		A	Approximate depths/levels	

Rev	By	Chkd	Apprvd	Date	Description
-	-	-	-	-	-

Client: Homes & Communities Agency

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Project: SSI REDCAR

Drawing: SSI 2 HISTORIC BOREHOLES AND TRIAL PITS LOCATION PLAN

Drawn by: JT	Date: 10/05/2017
Checked by: RK	Date: 15/06/2017
Approved by: IDK	Date: 15/06/2017
Drawing No. FIGURE 5	Revision -

Drawing Scale: 1:3000 @ A1; 1:6000 @A3

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Figure 6 –Site Constraints Plan

N

SOUTH GARE BREAKWATER

D
HIGH RISK
ASBESTOS
MODERATE RISK
ORGANIC/INORGANIC COMPOUNDS

E
VERY HIGH RISK
ORGANIC/INORGANIC COMPOUNDS
HIGH RISK
ASBESTOS

G
VERY HIGH RISK
ORGANIC/INORGANIC COMPOUNDS
ASBESTOS
HIGH RISK
METALS
SULPHATES/SULHPIDES
PCB'S - SUBSTATIONS
FLUE DUST/COAL DUST

J AND K
HIGH RISK
METALS
SULPHATES/SULPHIDES
PH
MODERATE RISK
ASBESTOS
ORGANIC/INORGANIC COMPOUNDS

C
HIGH RISK
METALS
SULPHIDE/SULPHATE
PH

I
MODERATE RISK
ORGANIC/INORGANIC COMPOUNDS
SOLVENTS/CHEMICALS
ASBESTOS

A
VERY HIGH RISK
ORGANIC/INORGANIC COMPOUNDS
HIGH RISK
PCB'S
ASBESTOS

B
VERY HIGH RISK
ORGANIC/INORGANIC COMPOUNDS
HIGH RISK
PCB'S
ASBESTOS

F
HIGH RISK
ORGANIC/INORGANIC COMPOUNDS
ASBESTOS
PCB'S - SUBSTATIONS
MODERATE RISK
METALS

H
HIGH RISK
METALS
ASBESTOS
PCB'S - SUBSTATIONS
COAL DUST

L
VERY HIGH RISK
ORGANIC/INORGANIC COMPOUNDS
HIGH RISK
METALS
SULPHIDES/SULPHATES
ASBESTOS
PCB'S

SSI 1

AREA	NAME	VERY HIGH RISK	HIGH RISK	MODERATE RISK
M	Made Ground	Metals, sulphides/sulphate		Asbestos, Hydrocarbons
M	Roads/parking ares			Elevated pH Hydrocarbons
M	Rail			Metals,
M	Miscellaneous pipes, tanks not water related including Coke Oven Gas Main		Asbestos, Organic and Inorganic Compounds	
M	Tidal Flats			Elevated pH, Soil Gases

NOTES

1. MADE GROUND OVER ALL AREAS
VERY HIGH RISK: METALS, SULPHIDES/SULPHITES
MODERATE RISK: ASBESTOS, ORGANIC/INORGANIC COMPOUNDS, PH SOIL GASES.

KEY

- A COKE OVENS
- B BY-PRODUCTS PLANT
- C COKE STOCK AREA
- D LIQUID NITROGEN STORAGE PLANT
- E FUEL OIL STORAGE
- F POWER PLANT
- G BLAST FURNACE
- H BLAST FURNACE STOCKHOUSE
- I MAIN WORKSHOPS/STORES
- J DISPOSAL AREA
- K PONDING AREA
- L HISTORIC STEEL AND PROCESSING PLANT
- M REMAINING SITE AREAS
- SSI 2 SITE AREA
- SOUTH GARE BREAKWATER
- HISTORICAL TANK
- PRESENT TANK
- 11KV SUBSTATION
- 66KV SUBSTATION

Rev	By	Chkd	Apprvd	Date	Description
-	-	-	-	-	-

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Homes & Communities Agency

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Project
SSI REDCAR

Drawing
SSI 2
SITE CONSTRAINTS

Drawn by: JT Date: 17/05/2017
Checked by: RK Date: 15/06/2017
Approved by: IDK Date: 15/06/2017

Drawing No.
FIGURE 6

Revision
-

Drawing Scale: 1:3000 @ A1; 1:6000 @A3

Drawing file path & name:
Xreference file path
User defined data