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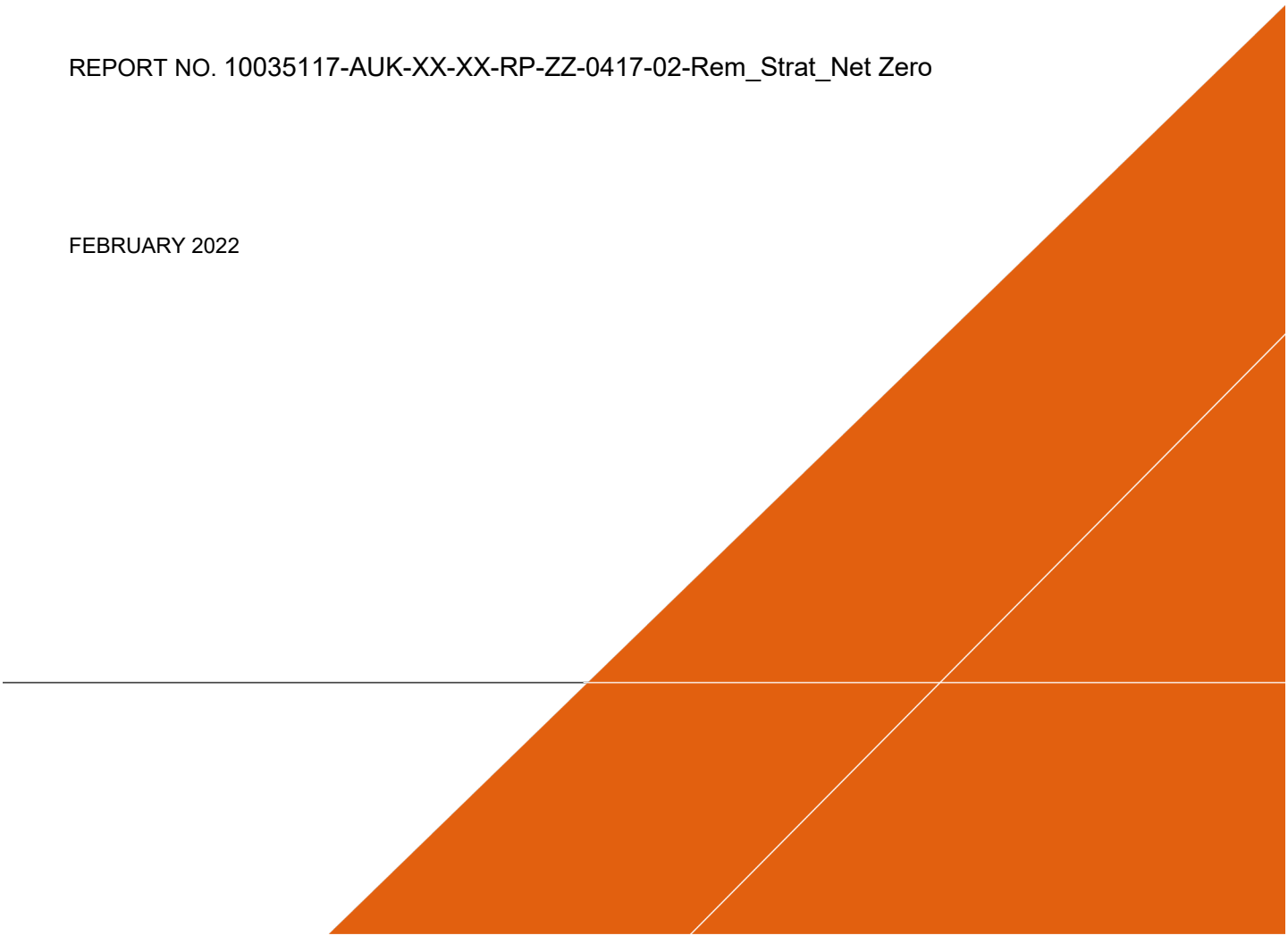
NET ZERO PLOT, TEESWORKS, REDCAR

Enabling Earthworks and Remediation Strategy Report

South Tees Development Corporation

REPORT NO. 10035117-AUK-XX-XX-RP-ZZ-0417-02-Rem_Strat_Net Zero

FEBRUARY 2022



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Net Zero, Teesworks, Redcar

Enabling Earthworks and Remediation Strategy Report

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Report No	10035117-AUK-XX-XX-RP-ZZ-0417-02-Rem_Strat_Net Zero
Date	FEBRUARY 2022

VERSION CONTROL

Version	Date	Author	Changes
01	November 2021	BLG	First Draft
02	February 2022	JM	Minor changes to DoWCoP discussion and updates to cut and fill drawing, text clarifications.

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1 INTRODUCTION

1.1 Project Aims and Objectives

The Net Zero Teesside (NZT) plot is a land parcel situated within the wider Teesworks area located across the Redcar, Lackenby, Grangetown and South Bank conurbations of the Borough of Redcar & Cleveland, set in the industrial area generally known as 'South Tees'.

The South Tees Regeneration Masterplan has been developed detailing the industrial-led regeneration of the Former Redcar Steelworks into a world class employment-generating zone and economic growth enabler for the Tees Valley.

The Masterplan has identified the NZT area as being located within the North Industrial Zone. The site is a priority development area.

Arcadis understand that BP Plc are the prospective tenant for the NZT site and have commissioned independent ground investigations of the site and surrounds. It is understood that the intended end use of the site is for development into a carbon capture, utilisation and storage facility.

The overarching aim of the works is to deliver a sustainable ground remediation strategy for the contract site which is compliant with regulatory needs (Local Authority and Environment Agency) and has their approval in principle. The specific objectives of this phase of works is to review the output of the environmental and geotechnical site investigation and risk assessment works and identify an applicable remediation strategy for the site.

This document is intended to support the discharge of planning conditions associated with remediation at the plot.

1.2 Contract Details

Arcadis (UK) Limited (Arcadis) were appointed by South Tees Development Corporation (STDC) to develop a remediation strategy to address environmental constraints relating to ground conditions identified by the physical ground investigation works conducted at the NZT plot.

The work was carried out in accordance with the proposal "Teesworks, Net Zero Teeside Plot – Planning and design technical Support" dated 20th October 2020.

The Site area, as provided by STDC is presented in the below Figure 1 and included in Appendix A.

SITE AREA	PLOT REF	PLAN AREA (m2)	PLATFORM LEVEL (M AOD)	REMEDIATION DIG LEVEL (M AOD)	CUT FROM EXISTING GROUND TO REMEDIATION DIG LEVEL (M3)	FILL FROM EXISTING GROUND REMEDIATION DIG LEVEL (M3)	FILL FROM REMEDIATION DIG LEVEL TO PLATFORM LEVEL (M3)	NET (M3)	SURPLUS CUT/DEFICIT FILL	TOTAL (M3)
NZT OPTION 1 FGL 7.3M AOD	NZT GREEN	200,225	7.3	4.8	525,691	0	500,563	25,129	SURPLUS CUT	**4,691**
	NZT ORANGE	99,651	7.3	4.8	186,236	2,458	249,128	-65,350	DEFICIT FILL	
	NZT PINK	91,513	7.3	3.8	365,207	0	320,296	44,912	SURPLUS CUT	
				TOTALS	**1,077,134**	2,458	**1,069,986**			
	NZT VOID ALLOWANCE	391,389	-	-	0	0	36536	-36,536	DEFICIT FILL	-36,536
	NZT GREY	271,238	0.2m SCRAPE	0.2	54,248	0	0	54,248	SURPLUS CUT	**54,248**
									TOTAL	**22,402**

Millimetres 100 10 0

DO NOT SCALE

NOTES

1. DO NOT SCALE FROM THIS DRAWING
2. IN ALL AREAS, PARTICULARLY THE GREEN AND PINK SHADED AREAS, THERE IS A FIRM LIKELIHOOD THAT EXCAVATION WILL NEED TO BE ADVANCED TO GREATER DEPTHS LOCALLY TO REMOVE CERTAIN BURIED STRUCTURES/FEATURES AND/OR TO ADDRESS THE REMOVAL OF CONTAMINATED SOILS

KEY

NZT SITE DEVELOPMENT BOUNDARY, INCLUSIVE OF TEMPORARY CONSTRUCTION LAYDOWN AREA.

THIS FORMS THE ENVELOPE OF THE REMEDIATION WORKS CONTRACT, EXCLUSIVE OF NOMINAL OVER DIG AT ONE OR MORE OF THE BOUNDARIES AND AREAS EXTERNAL TO THIS SITE THAT MAY BE ASSIGNED FOR MATERIALS PROCESSING

THE PROPOSED FINISHED GROUND LEVEL FOR THE REMEDIATION WORKS IS 7.3 AOD

REQUIRED MINIMUM EXCAVATION DEPTH IS 2.5m BELOW THE PROPOSED FINISHED REMEDIATION WORKS LEVEL, i.e., 4.8m AOD

REQUIRED MINIMUM EXCAVATION DEPTH IS 3.5m BELOW THE PROPOSED FINISHED REMEDIATION WORKS LEVEL, i.e., 3.8m AOD

REQUIRED GROUND REMEDIATION WORKS WILL TYPICALLY INVOLVE A LIMITED PROGRAMME OF EXCAVATION AND FILLING (TO SHALLOWER DEPTHS THAN THE AREAS SHADED GREEN AND PINK), WITH THE NEED TO REMOVE BURIED RELIC FOUNDATIONS AND SIMILAR BEING MORE SELECTIVE.

WORKS TO THIS AREA MAY ALSO INCLUDE FILLING UTILISING RESIDUAL MATERIALS FROM THE GREEN, PINK AND GREY SHADED AREAS.

THIS IS THE PROPOSED CONSTRUCTION LAYDOWN AREA FOR THE FOLLOW-ON NZT PROJECT, THAT WILL BE ACCESSED, IN PART, POTENTIALLY FROM JULY 2023, WITH OCCUPANCY INCREASING TO THE END OF 2023.

THE REQUIRED GROUND REMEDIATION WORKS WILL LARGELY BE CONTAINED TO SITE CLEARANCE, A SURFACE SCRAPE, AND A GENERAL, RELATIVELY MINOR CUT/FILL LEVELING OF THE AREA, FOLLOWING WHICH, THE AREA MAY BE CAPPED WITH GRANULAR FINISHING LAYER.

THIS DRAWING HAS BEEN PRODUCED WITH REFERENCE TO THIRD PARTY RECORDS, EVERY EFFORT HAS BEEN MADE TO PRESENT THE INFORMATION ACCURATELY. HOWEVER BEFORE GROUND BREAKING, APPROPRIATE MEASURES MUST BE TAKEN TO ENSURE THE LOCATIONS OF THE BURIED SERVICES.

FOR INFORMATION

Rev.	Date	Description	By	Chk'd	App'd
B	21.02.22	VOLUMES UPDATED	LCD	LCD	JMC
A	15.02.22	FIRST ISSUE	KW	LCD	JMC

STDC
Teesside Management Offices,
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www.southteesdc.com

South Tees Development Corporation

Project Title:

TEESWORKS
The UK's largest industrial zone

Drawing Name:

NET ZERO TEESSIDE OUTPUT FOR REMEDIATION STRATEGY/MMP

Drawn by: KW	Date: FEB 2022
Checked by: LCD	Date: FEB 2022
Approved by: JMc	Date: FEB 2022
Drawing Number: TSWK-STDC-NZT-ZZ-DR-C-0005	Revision: B
Drawing Scale: 1:2000	Page Size: A1

1.3 Report Aims

The aim of this remediation strategy document is to use the available information to assess feasible remediation strategies to address the active source-pathway-receptor linkages identified by the site conceptual site model (CSM) for the contract area in order to develop the final remediation technology selection and design.

1.4 Previous Information

The following reports have been prepared for or include the Net Zero plot:

- *Net Zero Plot, Teesworks, Detailed Quantitative Risk Assessment* (DQRA), 10035117-AUK-XX-XX-RP-ZZ-0428-01-Net_Zero_DQRA, prepared by Arcadis for South Tees Development Corporation, dated January 2022 [Arcadis 2022a].
- *Earthworks Specification Net Zero Teeside Plot, Redcar,* 10035117-AUK-XX-XX-RP-ZZ-0420-01-Net_Zero_Earthworks, prepared by Arcadis for South Tees Development Corporation, dated February 2022 [Arcadis 2022b].
- *4153 & 4154 Area A Former Steelworks Redcar Contract 1 & 2 (Area A) (Final report)*, prepared by Allied Exploration and Geotechnics Limited (AEG) for South Tees Site Company Ltd, dated June 2018 [AEG 2018].
- *The Former SSSI Steelworks, Redcar: Priority Areas Within SSI Landholdings Contract, Contracts 1 and 2 (Area A): Environmental Risk Assessment Report*, Redcar Steelworks-AUK-XX-XX-RP-GE-0001-P1-SSI1_SSI2A_GI_ERA_Final, prepared by Arcadis for South Tees Site Company Ltd, dated June 2018 [Arcadis 2018a].
- *The Former SSSI Steelworks, Redcar: Priority Areas Within SSI Landholdings Contract, Contract 1 and 2A Site Condition Report*, Redcar Steelworks-AUK-XX-XX-RP-GE-0001-02-SSI1_SSI2A_GI_SC, prepared by Arcadis for South Tees Site Company Ltd, dated August 2018 [Arcadis 2018b].
- *The Former SSSI Steelworks, Redcar: Priority Areas Within SSI Landholdings Contract, Contracts 1 and 2A: Geotechnical Risk Assessment Report*, Redcar Steelworks-AUK-XX-XX-RP-GE-0001-P1-SSI1_SSI2A_GI_GRA, prepared by Arcadis for South Tees Site Company Ltd, dated November 2018 [Arcadis 2018c].
- *The Former SSSI Steelworks, Redcar: Priority Areas Within SSI Landholdings Contract, Contract 1 and 2A: Ground Remediation Options Appraisal Report*, Redcar Steelworks-AUK-XX-XX-RP-GE-0001-01-SSI1_SSI2A_GI_ROA, prepared by Arcadis for South Tees Site Company Ltd, dated December 2018 [Arcadis 2018d].
- *SSI Redcar – SSI1, Factual Report – Initial Trial Pitting*, prepared by CH2M for South Tees Site Company Ltd, dated November 2017 [CH2M 2017a].
- *SSI Redcar – SSI2, Factual Report – Initial Trial Pitting*, prepared by CH2M for South Tees Site Company Ltd, dated November 2017 [CH2M 2017b].
- *SSI1 Redcar Works – Phase 1 Geo-Environmental Desk Study,* 678079_SSI1_001 prepared by CH2M, dated August 2017 [CH2M 2017c]
- *SSI2 Redcar Works – Phase 1 Geo-Environmental Desk Study*, 678079_SSI1_001 prepared by CH2M, dated August 2017 [CH2M 2017d]
- *Former SSI Steelworks, Redcar – Initial Ground Investigation Works*, Geoenvironmental Summary, prepared by CH2M for South Tees Site Company Ltd, dated May 2018 [CH2M 2018].
- *Soil and Groundwater Baseline Characterisation Study*, Teesside Works, prepared by Enviros for Corus UK Ltd [Enviros 2004], Comprising:
    - Volume 1 – Factual Report, Ref. Rlp250604corusteessidefactual.Doc dated 25th June 2004 and marked Final;

  - Volume 2 – Interpretive Report Ref. Mwicorusdraftinterpretivemmdv#2.Doc dated 25th June 2004 and marked Final; and,
  - Volume 3 – Summary Report dated June 2004

Arcadis have also been provided with the following report pertaining to the Site:

- *Preliminary Onshore Ground Investigation For Net Zero Teeside (NZT) – South Tees Development Corporation (STDC) 'Main Site' And Onshore CO2 Export Pipeline Corridor*, prepared by AEG for AECOM, dated September 2021 [AEG 2021a].
- *Net Zero Teeside – Environmental Statement Volume III – Appendices*, EN010103-001064-NZT DCO 6.4.11 ES Vol III Appendix 9C WFD Assessment, Prepared by AECOM for BP [AECOM 2021b].
- *Net Zero Teeside – Environmental Statement Volume I Chapter 10*, EN010103-000902-NZT DCO 6.2.10 ES Vol I Chapter 10 Geology and Contaminated Land, Prepared by AECOM for BP [AECOM 2021c].
- *Former Steelworks Land, South Tees Outline Remedial Strategy*, Prepared for South Tees Development Corporation by Wood, ref 41825-wood-XX-XX-RP-OC-0001_S0_P01 dated 25th June 2019 [Wood 2019].
- *Onshore Unexploded Ordnance Threat and Risk Assessment with Risk Mitigation Strategy: Net Zero Teesside*, Prepared for BP Plc by AECOM and 6 Alpha, NS051-CV-REP-000-00001 dated March 2021.

This Strategy document should be read in conjunction with the aforementioned reports.

1.5 Reliability / Limitations of Information

A complete list of Arcadis' Study Limitations is presented in Appendix B.

It should be noted that ground conditions between exploratory holes may vary from those identified during the ground investigations that this report is based upon; any design should take this into consideration. It should also be noted that groundwater levels may be subject to diurnal, tidal, seasonal, climatic variations and those recorded in this report are solely dependent on the time the ground investigation were carried out and the weather before and during the investigation work.

2 Environmental Setting and Development Constraints

This section incorporates a review of the above reports listed in Section 1.4.

2.1 Site Description and Setting

The site is dominated by large expanses of relatively flat artificial topography at between 6 - 8m above Ordnance Datum (AOD), lower platforms are present north of the Sinter Plant and to the north east around the former Iron Ponds. The region is divided by roads, steelworks structures; including the Teesside Management Office (TMO), Coal Blending Plant and RDL Stores, Sinter Plant, D. Jones Construction and Haulage Limited compound (former Tube City). Railway lines and the Blue Main Road form the southern boundary of the site, the former Hot Metal Route railway bisects the northern half of the site. Tunnels associated with the former Pellet Plant may also be present on site.

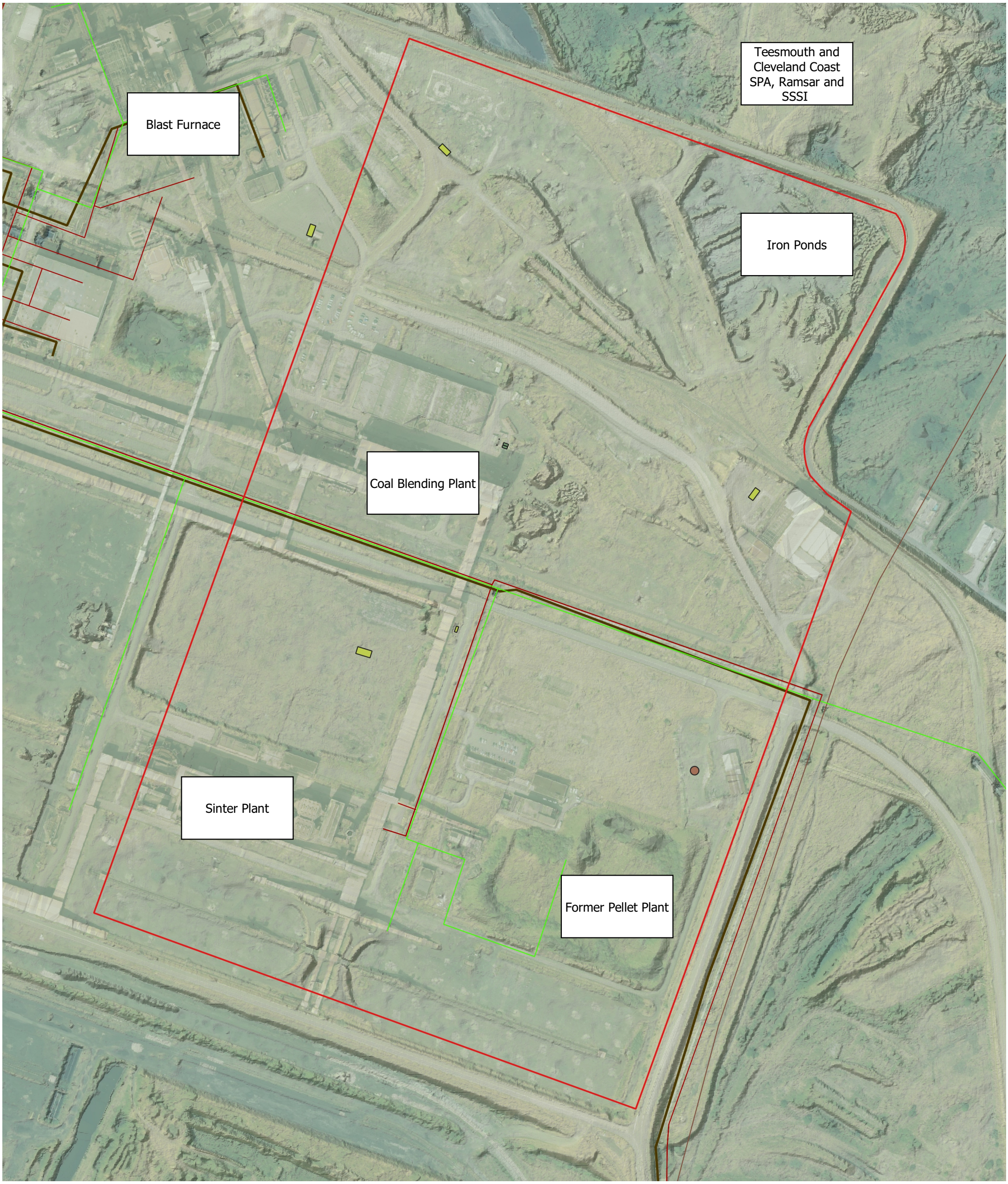
In general, the roadways are level with the surrounding land, however, the roads running along the eastern and southern boundaries of the site are approximately 3-4m higher, with steep slopes leading onto the site. Mounds and stockpiles are present across parts of the site primarily in the Iron Ponds area, around the Former Pellet Plant.

The ground around the TMO and north of the sinter building is primarily of soft landscaping with areas of gravel. The southern, central and western portions of the site are formed with compacted gravel comprising sinter where the former coal, ore and sinter stocks were located. These stocking yards are traversed by covered conveyor belts which transported the materials northwards to the blast furnace and coke ovens located within the adjacent Teesworks Foundry site.

The site infrastructure was undergoing demolition at the time of writing.

CATS Pipeline - The Central Area Transmission System pipeline, is a 36” (91cm) diameter gas pipeline running from the North Sea and making landfall northeast of the site. The pipeline runs in a south-southwest direction, parallel to and within 50 metres of the site’s eastern boundary. The pipeline started operating in 1993. While unlikely to be contaminative, it’s an extremely sensitive asset and poses a significant constraint to be considered during the development of the plot.

The site setting and layout are shown on Figure 2 and in Appendix A.



Legend

Utilities STDC Data

TSWK-STDC-ZZZ-ZZ-M2-CU-0004

- CokeOvenGasAboveGround_Cleaned
- RWLFoul_FormerCessPit
- Industry water
- AreaWorkshops_GasOilTank
- FuelOil
- CATPipeline
- RWLFoul_CessPit_SepticTank
- CokeOvenGasAboveGround

Drawings

Net Zero

- STDC_Remediation_Boundary

Bing Mapping

Lidar Data

- -2.5
- 7.0
- 16
- 25
- 35

Notes:

CONTACT ARCADIS IN CASE OF ANY QUERIES.

Not all utilities shown

N

Title: Net Zero Site Setting

Site: Teesworks - Net Zero Site

Client:
South Tees Developement Corporation

Project:
37774100

Figure 2

Date: 15/11/2021
Drawn By: JALM
DRG No: 110035117-AUK-XX-XX-DR-ZZ-0421-01-Net_Zero_Setting

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2.2 Geology

The ground investigation data [CH2M 2017a & 2017b, Arcadis 2018a & 2018b, and AEG 2021] indicates a substantial thickness of Made Ground at the site overlying the natural deposits. Made Ground was encountered at all locations and ranged in thickness from 0.9m in MS\BH04 to 8.9m in S1-BH14, with the deepest Made Ground identified in the south of the site.

Natural deposits comprising Tidal Flat Deposits were identified immediately underlying the Made Ground, these were hard to distinguish from Blown Sand deposits which are also indicated as being present on geological mapping. Glacial Till or occasionally Glaciolacustrine Deposits of varying thicknesses was identified below the Tidal Flat Deposits, where present the Glaciolacustrine Deposits were underlain by Glacial Till.

The Redcar Mudstone was proven to underly the Superficial Deposits across the majority of the site and was recovered as an extremely weak to weak grey mudstone. Mudstones of the Penarth Group were found to outcrop directly beneath superficial deposits in the north west corner of the Site, and were underlaid by rocks of the Mercia Mudstone Group. Arcadis 2018a identified that no Glaciolacustrine Deposits or Glacial Till are present overlying the bedrock to the east of the site.

Depth of bedrock below ordnance datum generally increased towards the north.

Two principal types of Made Ground were noted:

- **Slag-dominant material:** Generally ranging from gravel to boulder size fragments and intermixed with other types of manmade fragments including brick, concrete, coal, sandstone, and clinker. The slag material generally ranged from light grey to dark grey/black in colour, but a wide range of other colours were also noted including grey brown, red brown and orange brown. Discolouration of the slag surface was also noted with white crystallisation/discolouration often noted on the outer surface.
- **Granular Made Ground:** Generally described as a sandy gravel with varying amounts of clay, cobbles and gravel. Gravel and cobbles include brick, concrete and other demolition materials, slag was not the dominant constituent although often still present within the soil matrix.

In addition, the following Made Ground Types were encountered

- **Cohesive Made Ground:** Generally described as soft to very stiff clay containing minor constituents of sand, gravel and cobbles. Gravel and cobbles include brick, concrete and other demolition materials, slag was not the dominant constituent although often still present within the soil matrix.
- **Sinter:** Widely identified as a surfacing material across the southern area of the site by CH2M and generally described as black fine gravel.
- **Waste:** Comprised significant amounts of waste materials including metal, wood, and plastic in addition to the Made Ground deposits.

2.3 Hydrogeology

The south of the site was reclaimed from the Tees Estuary or low lying areas Tidal Flat Deposits immediately above high water by the placement of biproducts from the steel making process. Resting water level in wells installed at the site is noted to generally be within the Made Ground (resting at between 1 and 6m below ground level (bgl)) unit suggesting a continuity between the two units. Groundwater flow was noted to be towards the north within the Tidal Flat Deposits and the northeast within the Redcar Mudstone Formation, this flow direction is towards the coast.

Although Unproductive Strata, the site data indicates the potential for horizontal and vertical migration of groundwater within more permeable horizons of the Glaciolacustrine Deposits and Glacial Till. In areas where Glaciolacustrine Deposits and Glacial Till are absent to the east of the site and Tidal Flat Deposits are present overlying the bedrock continuity between the aquifers is likely. The hydrogeology is summarised in the table below, these classifications are in agreement with Wood 2019 and AECOM 2021c:

Geology	Aquifer Classification	Groundwater flow
Tidal Flat Deposits	Secondary (A) Aquifer	North
Glaciolacustrine Deposits (GLLDD-XCZ)	Unproductive Strata	Flow dictated by localised preferential pathways
Glacial Till	Unproductive Strata	
Redcar Mudstone Formation	Secondary (undifferentiated) Aquifer	North to north east
Penarth Group (northern corner of site only)	Secondary (B) Aquifer	Unknown based on site data locally expected to the north
Mercia Mudstone (northern corner of site only)	Secondary (B) Aquifer	Unknown based on site data locally expected to the north

Blown Sands (Secondary A Aquifer) are indicated by geological mapping of the site however these have not been conclusively identified by ground investigation. The Mercia Mudstone in underlain by the Sherwood Sandstone (Principal Aquifer) although this is understood to be at significant depth (estimated at 200m bgl from geological mapping) and was not present at 40m bgl during AEG 2021 works.

2.4 Hydrology

The South Gare and Coatham Coastline is present approximately 500m to the north of the site boundary. The South Gare and Coatham Sands is designated as a Site of Special Scientific Interest (SSSI), and the Teesmouth and Cleveland Coast is designated as a Special Protection Area (SPA).

In addition, a number of ponds (closest within 20m of the site) were formerly present between the site and South Gare and Coatham Dunes within an area of off site made ground. It is understood that these ponds were fed from surface runoff from operation of the Redcar Blast Furnace and have reduced significantly since termination of operations at the Steelworks. The Water Framework Directive Assessment for the site [AECOM 2021] identify the ponds to:

"Appear to have formed in depressions in the relatively impermeable historic slag deposits that lie between the PCC Site and the more natural sand dunes that have evolved adjacent to the Tees Bay shoreline. Based on site visits between October 2020 and January 2021, they appear to be predominantly rainwater fed with little influence from tidal variation and groundwater."

Given the significant reduction in the site of the ponds since cessation of production at the site and given a longer term trend of dune slack succession identified by AECOM [2021], there is not considered to be a significant pathway between the ponds and on site groundwater.

2.5 Data Gaps

Arcadis have reviewed the distribution of historical investigation at the site, including available soil and groundwater sampling. A potential data gap has been identified in the vicinity of the former blast furnace stock house. This area is understood to currently be inaccessible owing to ongoing demolition works.

The findings of a historical investigation [Enviros 2004] have also been reviewed for this report however it is recognised that these may not represent current conditions.

2.6 Conceptual Site Model

2.6.1 Environmental

An Environmental Risk Assessment (ERA) was completed in 2018 for the Net Zero site as part of a wider landholding and is documented in Arcadis [2018a]. As part of this study a conceptual site model (CSM) was developed based on ground investigation findings. The CSM identified a number of

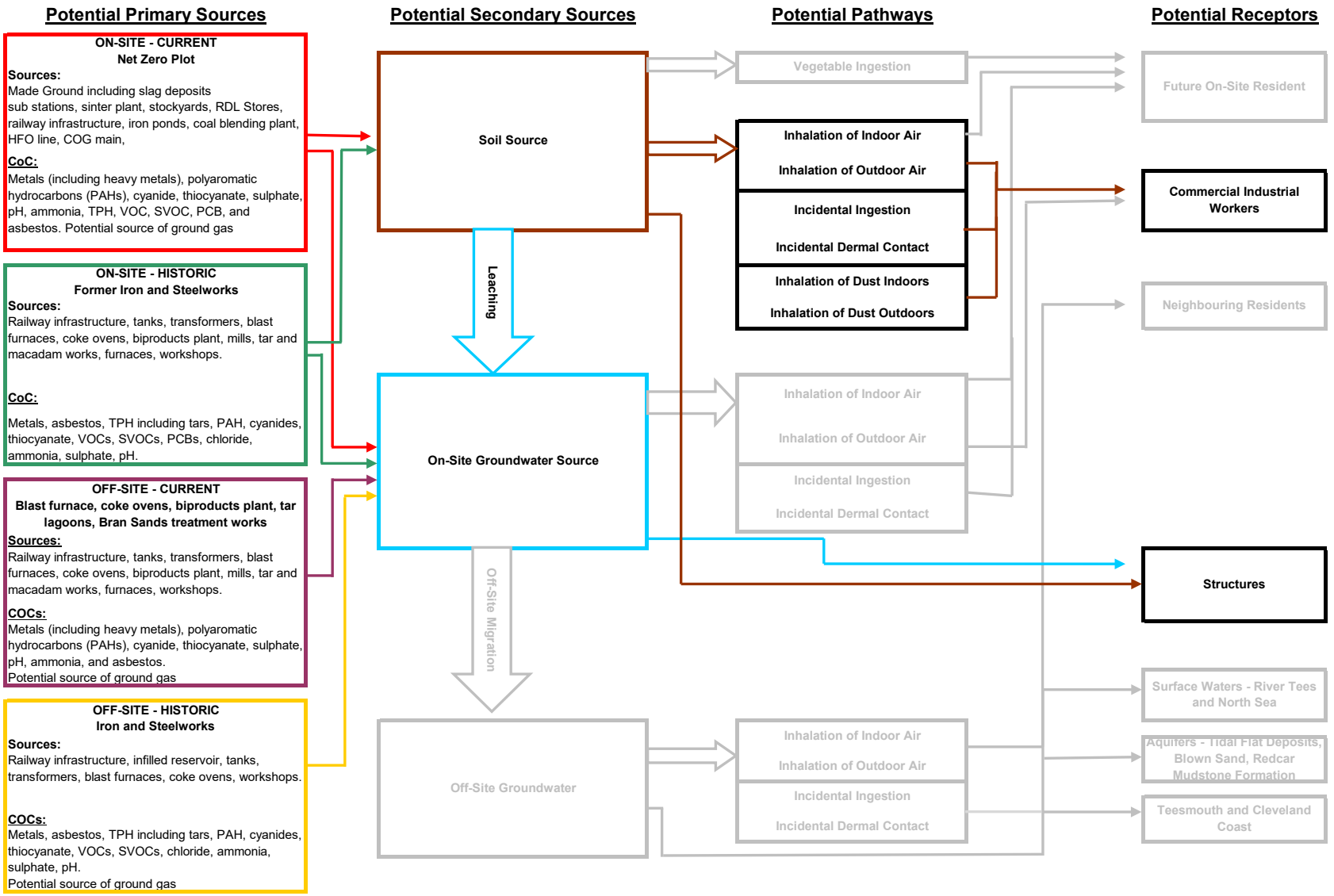
potentially active source-pathway-receptor (SPR) linkages the significance of which was assessed by comparison to appropriate Generic Assessment Criteria (GAC).

Arcadis have reviewed environmental data collected on behalf of BP, by AEG and documented in AEG [2021] as part of the DQRA [Arcadis 2022aa].

The aim of this report is to provide a remedial strategy for the site based on the mitigation of potential risks to identified human health receptors. It is assumed for the purpose of this document that remediation is not required for Controlled Waters. The risk to water resources (including exceedances of generic WQS values) is assessed in the DQRA [Arcadis 2022a].

The identified SPR linkages for the site are shown within the CSM presented below as Figure 3 and is also included in Appendix A.

Outline Conceptual Site Model - Commercial Industrial End Use



Key: Pollutant linkage not considered to present a significant level of risk

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2.6.2 Ground Gas

The ERA for Areas SSI1 and SSI2A [Arcadis 2018a] did not identify an unacceptable risk to human health or built receptors from the accumulation of ground gas. However, as the ground investigation was not designed with a particular redevelopment scenario in mind, the gas data monitoring was limited and may not be representative of the entire extent of the site under a particular redevelopment.

Additional ground gas monitoring at greater density is recommended prior to any specific redevelopment to determine the risk from ground gases at the site. The scope of this investigation and any subsequent remedial requirements would depend on the proposed redevelopment scenario. Arcadis understand from STDC that it is expected this would be the responsibility of the developer.

2.6.3 Geotechnical

It is not the specific intention of this Remediation Strategy to address geotechnical risks however these works have identified the following factors which may present significant development constraints at the site:

- Expansive slag deposits and refractory bricks may lead to disruption and damage of structures, hardstanding etc.;
- Due to long term creep settlement, the Made Ground and underlying Tidal Flat Deposits may possess inadequate bearing capacity to support proposed structures;
- Lateral and vertical changes in ground conditions;
- Anticipated total and differential settlement / heave in excess of the tolerable limits may occur due to changes in loading or groundwater regime;
- Sulphate attack on subsurface concrete; and,
- Obstructions within the made ground (boulder size fragments of slag and buried underground structures).

2.7 Requirement for Remediation

The results of contamination testing at the site has identified the following contaminants of concern above the screening criteria which pose a risk to Human Health based on an active SPR linkage. These are detailed within the DQRA [Arcadis 2022a] and summarised below.

2.7.1 Human Health

Asbestos in Soils

Asbestos fibres are present in shallow soils and pose a risk to Human Health receptors via the inhalation pathway.

Organic and Inorganic Contaminants

Levels of PAH were measured above the screening criteria in three locations, the SPL linkage for these contaminants is direct contact and dust inhalation. The majority of the exceedances were at depth (>0.5m bgl) and therefore the SPR linkage is not considered active for these detections, remediation is required for shallow detections as the SPL linkage is considered active.

Total cyanide was measured by CH2M above the screening criteria for free cyanide in one location, no free cyanide testing was conducted on the sample in question. Significant amounts of free cyanide testing across the Net Zero site conducted by later investigations did not identify free cyanide levels in excess of the criteria. Further, it is noted that the highest levels of free cyanide identified were two orders of magnitude below the total cyanide detection discussed above and one order of magnitude below the screening criteria. As such the detection of total cyanide in not considered to represent an active SPR linkage.

2.7.2 Materials Impacted with Non-Aqueous Phase Liquids

Evidence of non-aqueous phase liquids (NAPL) and Tar have been identified primarily within the Made Ground and associated with subsurface or former above ground structures and plant. Further

consideration of the NAPL with respect to the risk to human health will be needed as part of the remedial strategy.

Materials impacted with NAPL and tar should not be reinstated due to being a primary source of contamination. The impacted materials will be required to be consigned to a treatment process to remove the NAPL element or disposed of at an appropriate waste facility under duty of care.

Review of previous investigations identified evidence of potential NAPL contamination on soils in the following locations during the ground investigation.

Location	Geology	Description	Source
S1-TPH07	Made Ground	Waste materials, oil contamination.	CH2M [2017a]
S2-TPA53	Made Ground	Possible tar pockets	CH2M [2017b]
S2-TPA61	Made Ground	Slight hydrocarbon sheen	CH2M [2017b]
S2-TPA62	Made Ground	Slight oil sheen at water level	CH2M [2017b]
MS\BH07 4.2-4.85m bgl	Made Ground	Tar coating on slag and tar odour	AEG [2021]
MS\TP06A	Made Ground	Sheen noted Potential solidified tar cladding on buried pipe	AEG [2021]
MS\TP10	Made Ground	Sheen noted	AEG [2021]

2.8 Unexploded Ordnance and Magnetic Anomalies

The AECOM Unexploded Ordnance (UXO) assessment [*Onshore Unexploded Ordnance Threat and Risk Assessment with Risk Mitigation Strategy: Net Zero Teesside]* completed for the Net Zero boundary indicates a High risk from UXO for excavations.

In addition, a magnetic anomaly was identified in location S2-BHA05 in the north of the site at a depth of approximately 11m bgl. Given the depth of the anomaly, further inspection was not possible, and on the advice of the ordnance engineer, the borehole was terminated at this depth.

While this magnetic anomaly cannot categorically be identified as UXO, the presence of UXO is one possibility and as such the anomaly needs to be treated as if ordnance was present. Should redevelopment require the installation of piled foundations or deep ground improvement, clearance of locations for potential UXO is recommended.

2.9 Archaeology

Archaeological surveys and assessment have not been made available to Arcadis at the time of writing this document. These documents should be reviewed when available to develop an appropriate mitigation and management strategy.

2.10 Ecology

The NZT site is bounded to the north by the Teesmouth and Cleveland Coast SPA, Ramsar and SSSI site.

A Habitats Risk Assessment (HRA) is being completed by a third party for the site [*INCA Report 2021-81 NZT Remediation Shadow Habitats Regulations Assessment: Stage 1 Screening and Stage 2 Appropriate Assessment*].

2.11 Invasive Species

Invasive species have been identified within the wider Teesworks site.

It is a requirement to prevent invasive species on your land from spreading into the wild and causing a nuisance including contaminated soil or plant material from any waste you transfer being spread into the wild.

2.12 Flood Risk

The risk of flooding from rivers and the sea has been assessed by reviewing Environment Agency flood maps for the area which indicate the risk of flooding is “Very Low” with a less than 0.1% chance of flooding in any year.

A Flood Risk Assessment is being completed by a third party for the site.

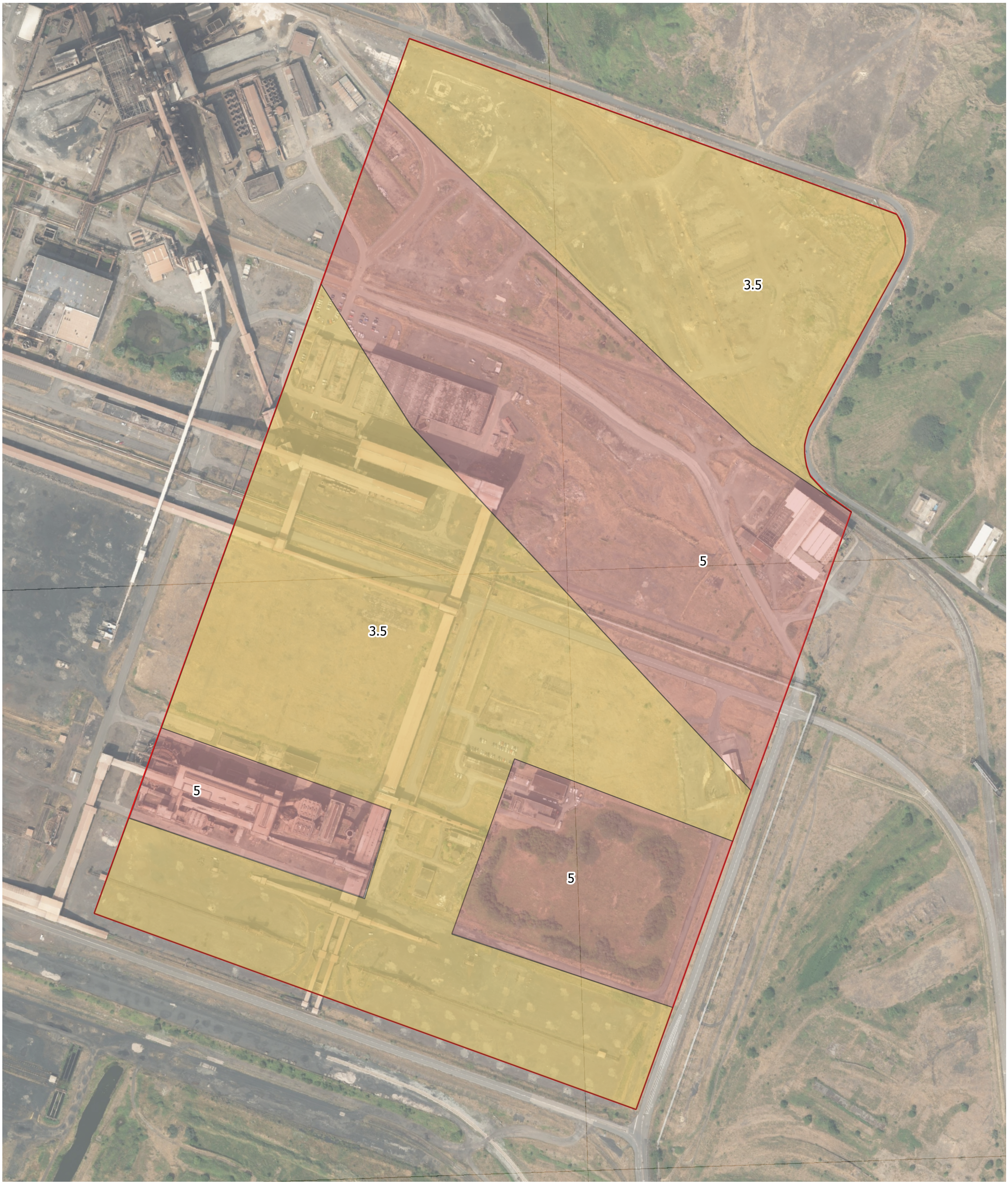
2.13 Proposed Redevelopment and Enabling Works

Arcadis understand STDC are to complete enabling works to create an environmentally suitable development platform for future redevelopment. These works will include turnover of the Made Ground within the subsurface to a depth of up to 3.5 m Below Finished Level (bfl) depending on location as shown on Figure 1.

The finished level for the site is currently set at 7.3mAOD and the turnover of the Made Ground is to be conducted down to the depths (bfl) indicated in Figure 1, including removal and crushing of relic structures and obstructions, removal and treatment of environmental contamination as required and reinstatement with suitable fill material to formation levels for development.

In all areas, particularly the green and pink shaded areas as shown in Figure 1, there is a potential requirement that excavations will need to be advanced to greater depths locally to remove certain buried structures/features and/or to address the removal of contaminated soils. Any requirement for deeper excavation works will be assessed on a case specific basis following consultation with stakeholders.

In light of the above and to provide maximum flexibility under planning the anticipated maximum depths of excavation from the existing site levels are shown on the below Figure 4 and included within Appendix A (excavation to these depths will be allowed under planning but may not be required during the remediation). It should be noted that these are depths from existing site levels.



Legend

Remediation Excavations

Bing Mapping

Maximum Depth (mbgl)

- 3.5
- 5

Drawings

- STDC_Remediation_Boundary

Notes:

CONTACT ARCADIS IN CASE OF ANY QUERIES.

Dig depths are calculated to give maximum flexibility under planning and should not be considered part of the STDC landlord specification, or to infer any contractual requirement.

N

Title: Net Zero Site Maximum Excavation Depth Plan (Curent Site Levels)

Site: Teesworks - Net Zero Site

Client:
South Tees Developement Corporation

Project:
37774100

Figure 4

Date: 15/11/2021
Drawn By: JALM
DRG No: 10035117-AUK-XX-XX-DR-ZZ-0422-03-Net_Zero_Rem_Ex

ARCADIS Design & Consultancy for natural and built assets

It is not STDC's intention to remove piles to depths below those defined by Figure 1 to the 7.3m AOD development level or address the potential for future slag expansion. If deemed necessary, specific engineering controls will be installed by a future developer.

It is understood that the site is proposed to be redeveloped as a carbon capture and storage facility, however no detailed redevelopment design is currently available for the site. As such, this strategy has been produced on the assumption that any redevelopment of the site will be for a generic commercial industrial end use. Remediation technologies have been selected based on Arcadis' professional judgement and experience of large-scale redevelopments of brownfield sites. The site is part of a wider STDC landholding and Arcadis recommends the remediation approach is considered holistically with the wider redevelopment of the Teesworks Site.

2.14 Materials Management

Given that remediation measures involve the movement of materials around the Net Zero site and potentially the wider STDC site it is important that they are not classified as a waste (as defined by Waste Framework Directive) on completion of the works.

2.14.1 Avoiding Waste Status

There are several different waste regulatory options available, the suitability of which is dependent upon the complexity of the site and the quantity/composition of the material to be reused. Based on the complexity of the site Arcadis recommend the most suitable option is via an application in accordance with CL:AIRE guidance 'Definition of Waste: Development Industry Code of Practice' (DoWCoP).

2.14.2 Definition of Waste: Development Industry Code of Practice

The Environment Agency (EA) has worked with industry through CL:AIRE to prepare the DoWCoP the purpose of which is to allow industry to regulate itself with respect to determining whether excavated materials have achieved non-waste status. The EA states that 'When a signed Declaration is sent to us (the EA) by a Qualified Person (QP) showing that excavated materials are to be dealt with as set out in the DoWCoP, we (the EA) will take the view that the materials on the site where they are to be used will not be waste.'

If materials are dealt within in accordance with the DoWCoP then the materials are unlikely to be waste. According to DoWCoP, there is no single factor that can be used to determine if something is a waste or when it ceases to be waste. However in the context of excavated materials used on sites undergoing development the following factors are considered to be of particular relevance.

- Factor 1 – Protection of human health and the environment – in all cases measures to protect the environment and prevent harm to human health have to be assessed and found to be adequate given the proposed use of the materials.
- Factor 2 – Suitability for use without further treatment - chemical and geotechnical properties have to be demonstrated to be suitable, and the relevant specification for its use must be met.
- Factor 3 - Certainty of use – The holder of the material must be able to demonstrate that the material will actually be used and that the use is not just a probability, but a certainty. In the case of Teesworks this will likely be via planning permission.
- Factor 4 – Quantity of material - Materials should only be used in the quantities necessary for that use, and no more. The use of an excessive amount of material will indicate that it is being disposed of and is waste.

In order to demonstrate that the four factors have been fulfilled will require preparation of various reports including:

- Site investigation report (Site Condition Report / Environmental Site Assessment).
- Quantitative Risk Assessment (QRA);
- Remediation Strategy or Design Statement;
- Materials Management Plan (MMP); and,
- Verification Report (on completion of the works).

In addition to the risk assessment, an MMP will be required detailing where soils will be moved to and how they will be tracked. Approvals will also need to be sought from the Local Authority and the Environment Agency (groundwater team) with respect to this remediation strategy. Planning permission may also be necessary to ensure QP approval of the DoWCoP.

Once this documentation is in place a QP will review the overall strategy and ensure that everything is in place prior to submitting a formal declaration to CL:AIRE (the scheme administrators) who will forward to the Environment Agency (waste team). On completion of the work a verification report will need to be completed.

2.14.3 Materials Management Plan

An MMP shall be prepared in accordance with CL:AIRE DoWCoP and authorised by a QP registered with CL:AIRE. The MMP will refer to the EA position on the reuse of slag rich Made Ground as per EA correspondence DoWCoP/2020 dated 15th December 2020. Excavated materials will be segregated and sorted into the following categories:

- Materials suitable for re-use on site including slag rich Made Ground (without needing additional treatment);
- Materials that require treatment in order to be suitable for re-use on site;
- Soils that require off-site disposal/treatment (not treatable);
- Soils containing asbestos for treatment and reuse or for off-site disposal;
- Excavated hard materials (such as concrete and brick) that may be crushed to produce suitable material for use as infill in the Work; and
- Other materials that require off-site disposal (household waste, electrical goods, vegetation etc).

Where appropriate, existing oversize slag rich Made Ground, concrete, brick and other suitable building materials will be crushed (under the MMP) to an acceptable material as specified in the Earthworks Specification for reuse on-site in accordance with the MMP or other suitable end of waste quality protocol. Materials destined for re-use must meet the criteria proposed within the MMP or other relevant document.

2.14.3.1 Records to be made

The contractor will be required to maintain records of material excavation and movement in support of the MMP, these shall include but not be limited to

Records whilst excavating	Records whilst backfilling
Date	Date
Grid square of origin	Excavation area or stockpile of origin
Depth of origin	Volume
Type of material (Made Ground, Concrete, slag etc.)	Placement grid square(s)
Volume excavated	Depth placed
Material destination (if direct to processing and backfill the backfill area, stockpile, or treatment area)	Material type
Evidence of contamination	

3 Remediation and Excavation Objectives

The aim of the remediation works at the site is to address the identified development constraints pertaining to environmental ground conditions and to facilitate redevelopment for a generic future commercial / industrial end use.

The remediation works will be undertaken at the same time as enabling earthworks (detailed in Section 2.13) to create a suitable formation level, and therefore should be considered holistically with these works.

3.1 Remediation Objectives

The remediation objectives will be achieved by controlling or breaking the identified SPR linkage in order to mitigate identified risks to the identified environmental receptors. The remediation objectives are to:

- Manage the contamination in excess of screening levels including NAPL containing soils.
- Manage the identified pollutant linkage between potential asbestos containing materials that are anticipated to be within shallow Made Ground such that the exposure pathways for on-site commercial workers are inactive.
- Maximise the reuse of excavated soils by making them suitable for use under DoWCoP.
- To develop an unexpected contamination strategy in order to manage and mitigate the risks due to encountering additional materials as is commonplace during the preparation and reclamation of historical brownfield land.

3.2 Excavation Objectives

As the enabling earthworks are to be conducted alongside the environmental remediation it is considered prudent to incorporate the objective of the earthworks into the remediation strategy. The enabling earthworks objectives are to:

- Remove sub-surface obstructions within the Made Ground to a depth (bfl) as defined in Figure 1. Where obstructions extend below this depth their removal will be conducted on a case by case basis following consultation with stakeholders;
- Creation of a formation layer suitable (at 7.3 mAOD) for a generic commercial / industrial redevelopment;
- Manage perched and confined groundwater within the Made Ground encountered during excavations;
- Management of risk to external hardstanding, culverted waterways and utilities; and,
- Development of a UXO mitigation strategy.

Arcadis recommends the following excavation objectives are considered as part of the earthworks strategy and therefore require consideration as part of the Earthworks Specification and development plans:

- Consideration of the management and placement of slag and refractory materials excavated as part of the enabling earthworks; and,
- Protection of sub surface structures and utilities from attack due to aggressive ground conditions.

It is not the intention of this Remediation Strategy to fully address geotechnical development constraints at the site as these are the responsibility of the developer and dependent on a specific redevelopment scenario. It is anticipated that appropriate engineering controls will be developed by future site users at detailed design stage.

4 Enabling Earthworks and Remediation Strategy

The strategy for the enabling earthworks and remediation of the Net Zero site should be considered within the wider context of the Teesworks reclamation and remediation. The excavated materials identified as not suitable for direct reuse will be consigned to a remediation process in order to meet the criteria for reuse after treatment. The exact technology is dependent on the volume and availability of the material and the timescale required to complete the remediation. It is currently envisaged that the treatment of materials could be undertaken on the Lackenby Treatment Area as a single location or potentially as part of a hub and cluster arrangement should one be established for the wider Teesworks site.

4.1 Aim

The aim of the works is to:

- Remove underground relic structures and foundations in line with Figure 1;
- Processing Made Ground materials in order to make them suitable for use as backfill materials,
- Make the site suitable for future commercial / industrial end-use through SPR linkage breaks from materials impacted with asbestos, and PAHs; and,
- Reduce the geotechnical risks from slags and refractory materials removed as a consequence of the excavation works.

4.2 Overview of Required Works

In overview the enabling earthworks and remediation will comprise the following activities.

Enabling Earthworks

- Removal and processing of relic underground structures and foundations for reuse, to a depth of 2.5 to 3.5 m below finished level (bfl) to 7.3m AOD. The requirement to remove areas of deeper structures or foundations, if encountered, will be assessed on a case-by-case basis;
- Screening and crushing of Made Ground materials in order to make them suitable for reuse;
- Treatment of soils impacted with NAPL in order to make them suitable for reuse;
- Segregation of soils with ACM for treatment and reuse;
- Segregation and processing of refractory materials as far as practicable;
- Dewatering of below ground structures and excavations with management, treatment and disposal of water; and,
- Backfill of excavations to leave the site safe and level, with validated made ground, certified demolition arising, crushed concrete or imported fill.

Remediation

- Remediation of soils impacted with contaminants above target levels through capping of materials to manage SPR linkages driven by direct contact and dust inhalation pathways;
- Removal of NAPL and tar impacted soils to address risks to Human Health.

4.3 Works Approach

4.3.1 Enabling works

Prior to mobilisation and commencing the enabling earthworks and remediation the following documentation, notifications, permits and approvals shall be obtained and put in place:

- Approved Schedule;
- Construction Phase Health and Safety Plan;
- Method Statements and Risk Assessments;

- Occupational Health Plan;
- Environmental Permit;
- Trade Effluent Discharge Consent / Water Discharge Activity Environmental Permit;
- Traffic Management Plan;
- Construction Environmental Management Plan;
- Materials Management Plan;
- Emergency Response Plan; and,
- Surface Water Management Plan.

A site compound, including welfare facilities and parking will be required to be established in a suitable area on site. Temporary buildings, structures, equipment and facilities shall be properly maintained for so long as it is in use, and the compound, welfare and parking facilities cleared away on completion. Appropriate site fencing, signage and security shall be implemented to protect the works.

4.3.2 Environmental Permit

An Environmental Permit (EP) Mobile Treatment Licence is likely to be required in order to conduct works comprising the treatment and reuse of site won material identified as requiring remediation and the treatment of any contaminated waters recovered during the works. This is typically held and deployed by the party responsible for designing and managing the execution of the remediation who are responsible and accountable for compliance with regulatory requirements.

An EP deployment form will need to be submitted to and approved by the EA (Environmental Permit Team) detailing the remedial approach and associated engineering controls, prior to treatment being undertaken.

The processing of site won materials which do not require treatment for environmental purposes does not need to be conducted under an EP. If uncontaminated made ground is to be processed and an EP for mobile plant is not in place then an EA Standard Rules Permit for the low risk crushing and screening of materials will also be required.

4.3.3 Discharge Consent / Water Discharge Activity Environmental Permit

All accumulated, perched or ground water encountered within the Made Ground shall be collected in a holding tank or lined lagoon prior to any treatment and subsequent discharge. The incidental water shall either be:

a) discharged to foul sewer under a trade effluent consent agreed with the local sewerage undertaker and/or;

b) discharged to surface water under a Water Discharge Activity Environmental Permit (“WDA-EP”) from the EA.

The Contractor shall make arrangements to identify the most sustainable, compliant and cost-effective discharge method and ensure that relevant permissions and consents are received prior to discharging.

4.3.4 Materials Management

Remediation measures will involve the movement of materials. It is important that they are not classified as a waste (as defined by Waste Framework Directive) on completion of the works.

4.3.4.1 Avoiding Waste Status

As discussed in Section 2.13.3, there are several different waste regulatory options available, the suitability of which is dependent upon the complexity of the site and the quantity/composition of the material to be reused. It has been concluded the most suitable option is via an application in accordance with CL:AIRE guidance ‘Definition of Waste: Development Industry Code of Practice’ (DoWCoP). Please refer to section 2.13.3 for further details on this use of the DoWCoP.

4.3.4.2 Use of slag under the DoWCoP

Engagement with the Environment Agency was previously undertaken on the proposal to re-use iron & steel slag rich made ground under CL:AIRE DoWCoP on the Site of Origin at the Metals Recovery Area, South Bank.

The Environment Agency's position following this engagement is that the steel and iron slag that makes up the made ground located outside of designated former and current landfills is not waste and can be re-used under CL:AIRE DoWCoP based on the following parameters;

- *the developer/operator can demonstrate that the steel and iron slag was used for an intended purpose, i.e. to heighten and extend the marshy low-lying ground for the purpose to use and develop that land.*
- *the developer/operator can demonstrate that the steel and iron slag was deposited pre-Control of Pollution Act (1974). This is in line with our approach not to bring areas of land no longer regulated back into regulation unless not doing so would undermine our existing legislative regime.*
- *Should the re-development area incorporate areas of land that have clearly been designated 'landfill' (both under current permit and historical prior to waste legislation) then if this waste is excavated at any point, current waste regulations will apply for the treatment and/or disposal, recovery and re-deposit of the waste.*

4.3.4.3 Materials Management Plan

An MMP shall be prepared in accordance with CL:AIRE DoWCoP and authorised by a QP registered with CL:AIRE. Excavated materials will be segregated and sorted into categories as defined in Section 2.13.3

4.3.5 Soil Sampling

Soil sampling will be undertaken by an STDC appointed representative and at the frequency proposed in Section 4.3.8 and in line with the requirements set out in the Earthworks Specification.

Where samples are required to be taken from the excavation (representative of materials left in-situ or materials reused as backfill) locations shall be machine scraped across the validation sample location and a representative soil sample collected for analysis. Sample locations shall be defined on a predefined grid basis to ensure appropriate coverage and frequency.

Where samples are required to be taken from stockpiles of materials, composite sampling from stockpiles will be undertaken in order to collect a representative sample.

Further information on the proposed sampling strategy, including sampling frequency and testing schedule will be provided within the Earthworks Specification and the Materials Management Plan.

4.3.6 Excavations

4.3.6.1 General Excavations

The scope of the excavation works is outlined in Section 2.13. Where practicable obstructions will be removed and crushed for re-use on site. Materials which are impacted with contaminants to levels above the defined reuse criteria shall be treated using the remediation strategy or if treatment is not considered possible disposed of offsite under full duty of care.

Made Ground materials will require size screening and crushing to enable reuse. Any deleterious materials not suitable for incorporation into the fill material, such as scrap, wood, plastic, putrescible materials etc will be segregated and stored separately on site. Such materials will then be disposed offsite under full duty of care.

4.3.6.2 Slags and Refractory Materials

Ground conditions at the site present a number of potential geotechnical constraints. It is anticipated that the majority of these can be dealt with by adopting appropriate engineering controls at the development phase.

However, Arcadis recommend where potentially expansive refractory materials are excavated as part of the enabling excavations these be managed by Excavation, Separation, and Reuse in low risk areas of the site as defined by STDC. Treatment may also be undertaken if this is identified as feasible for the materials in the given timescale.

The above is intended to reduce rather than eliminate the risks from these materials. Additional management through the use of engineering controls are likely to be required depending on the final redevelopment, these are to be the responsibility of the developer.

4.3.6.3 Segregation and Stockpiling

Excavated materials identified by laboratory analysis as chemically unsuitable for direct reuse will be stockpiled for treatment. Stockpiled soils for treatment will be required to be placed on impermeable surfaces with covers and suitable drainage to collect and dispose of waters. Validation testing of these areas will be undertaken to prove the land quality pre- and post-remediation.

4.3.6.4 Surveying

All excavations shall be surveyed by the appointed Remediation Contractor to allow for accurate measurement of excavation extents and to establish remedial verification sample locations.

4.3.6.5 Relic Underground Structures and Services

The following shall be implemented with respect to relic structures:

- Relic structures shall be removed where encountered within the required excavation depth (Figure 1) in the Made Ground. Where relic structures are encountered within the dig profile (bfl) as defined by Figure 1 but continue below this level confirmation on the requirement to remove them below this depth shall be obtained from STDC. If removal is not required a record of the residual foundation or obstruction shall be made, recording the topographical coordinates, size and type.
- Where encountered, piled foundations shall be removed to the extent defined by Figure 1. A record of the residual foundation shall be made recording the topographical coordinates, size and type.
- Redundant pipework is likely to be encountered within the excavations which may act as preferential pathways for the migration of contamination. Where encountered redundant pipework will be removed from the excavations. Should complete removal not be possible or feasible then residual pipework will be sealed at the edges of excavations and the location recorded on an as-built survey.

The Net Zero site is currently to be redeveloped as a carbon capture and storage facility. No specific detailed development plans have been made available at the time of writing this remediation strategy and any future development plans may need to account for structures remaining *in-situ* or partially removed following these works depending on the specific redevelopment.

4.3.6.6 Boreholes

There are existing borehole installations across the Net Zero site. Where possible boreholes within defined excavation areas should be protected, however if this is not practicable, they are required to be decommissioned in accordance with the relevant British Standards and EA guidance.

4.3.6.7 UXO

A desktop UXO assessment has been completed for the STDC boundary. The outcome of the assessment indicates a Medium risk from UXO for borehole and excavation activities. In addition, and magnetic anomaly was detected in one location at 11m bgl. Further mitigation activities such as detailed risk assessment or site mitigations are considered essential to reduce the UXO risk on the site to As

Low As is Reasonably Practicable (ALARP). These additional mitigating factors should be defined within the Principal Contractors Construction Phase Plan (CPP).

4.3.6.8 Utilities and Services

A review of the available data sources provided to Arcadis has highlighted a number of live services and utilities that cross and bound the site: These services include;

- Coke Oven Gas main;
- Oxygen pipeline;
- HFO line;
- Below ground electric;
- CATS Pipeline;
- Industrial Water Supply; and
- Railway and railway network infrastructure.

Arcadis understand some of these services are in the process of being decommissioned. The remediation contractor should confirm the status of all utilities before works commence. There is the potential for other utilities to be crossing the site including redundant gas pipes, water pipes and electrical cables as well as live 3rd party utilities.

At the time of writing a constraints plan is not available which would identify which site services and 3rd party utilities are required to remain and be protected during the remediation and reclamation works. The constraints plan will be reviewed and accounted for within the Remediation Contractor's CPP.

4.3.7 Groundwater Management

Groundwater and accumulated water are anticipated to be encountered within excavations and subsurface structures. Where present this will require removal to facilitate excavation and backfilling works.

The Contractor shall minimise the quantity of water requiring pumping through backfilling excavations as soon as practicable and avoiding the potential for accumulation of rainwater in open excavations.

The Contractor shall ensure that recovered groundwater is sampled and classified to allow appropriate disposal, either via direct disposal to public foul drainage under discharge consent, *via* on site treatment and discharge to public foul drainage under consent, or by tankerage and disposal from site.

Any temporary storage of groundwater or accumulated water shall be within storage vessels, which are to bunded and equipped with drain-down and sampling valves.

4.3.7.1 Removal of NAPL on Groundwater

If free phase NAPL is encountered on the groundwater during excavation works, the Contractor shall undertake recovery prior to groundwater discharge. The Contractor shall continue the NAPL recovery process until no visible NAPL is observed or further recovery is not reasonably practicable (evidenced by diminishing recovery quantities i.e. base of asymptotic curve).

Where there is evidence of the presence of NAPL in the unsaturated zone, excavations will be extended to expose the groundwater table and identify if it is impacted by the above material and if groundwater treatment is required.

4.3.8 Remediation Criteria

The following Remediation Criteria have been developed for Human Health receptors at the Site (in order of priority):

- LQM/CIEH Suitable for Use Levels (S4UL) (LQM / CIEH, 2015),
- Department of Environment Food and Rural Affairs (DEFRA) Category 4 Screening Levels (C4SL) (DEFRA, 2012),
- Arcadis derived generic assessment criteria based on CLEA v1.07,
- United States Environmental Protection Agency (U.S. EPA) Regional Screening Levels (RSLs)

Wood derived GAC based on CLEA v1.07 were presented in the Wood 2019 [which considered the adjacent Teesworks Long Acres site] report for benzo(a)pyrene and naphthalene. It is understood that these values and the use of the LQM S4Uls were acceptable to the regulator for areas considered by Wood and therefore are considered by Arcadis to be also applicable to the Net Zero site.

The Criteria a presented in Appendix C

4.3.8.1 Compliance Sampling Frequency

Remediation Criteria Point	Remediation Objective	Compliance Criteria [1]
Excavation Extents in areas without NAPL	Ensure that concentrations of asbestos within soils within the uppermost 0.2m of materials do not exceed the defined risk-based thresholds	Composite soil samples do not exceed the Remediation Criteria. Samples collected at the following frequency • One sample per 50 linear metres of excavation from within the top 0.6m
	Ensure that soils remaining in-situ do not contain contaminant concentrations in excess of the remediation and reclamation criteria	Composite soil samples do not exceed the Remediation Criteria. Samples collected at the following frequency • One sample per 50 linear metres of excavation; and, • One sample per stratum or at 2.5m vertical intervals (whichever is the greater) • One sample per 100x100m extent of excavation base • One sample per 2,000m^3 of stockpiled slag rich deposits. • One sample per 1,000m^3 of stockpiled excavated Made Ground. • One sample per 2,000m^3 of stockpiled crushed site aggregate
Excavation Extents in areas with NAPL	Ensure that concentrations of asbestos within soils within the uppermost 0.2m of materials do not exceed the defined risk-based thresholds	Composite soil samples do not exceed the Remediation Criteria. Samples collected at the following frequency • One sample per 25 linear metres of excavation from within the top 0.6m

[1] Sampling frequency to be formalised and agreed as part of the Earthworks Specification and MMP

Remediation Criteria Point	Remediation Objective	Compliance Criteria [1]
	Ensure that soils remaining in-situ do not contain contaminant concentrations in excess of the remediation and reclamation criteria	Composite soil samples do not exceed the Remediation Criteria. Samples collected at the following frequency • One sample per 25 linear metres of excavation; and, • One sample per stratum or at 1.0m vertical intervals (whichever is the greater) • One sample per 50x50m extent of excavation base • One sample per 625m^3 of stockpiled excavated Made Ground. • One sample per 625m^3 of stockpiled crushed site aggregate
Imported Materials (Not expected to be required but included for completeness)	Ensure that materials imported and used at the site do not introduce environmental or human health risks	Soil samples collected at a frequency of one sample per 2,000 m^3 of imported material (with a minimum of three samples per source) do not exceed the Remediation Criteria.
Accumulated NAPL	Ensure that no NAPL is present on groundwater as far as is reasonably practicable	No visible NAPL to be recorded on groundwater or accumulated water as far as reasonably practicable[2]

[2] To consider that further free phase recovery is not reasonably practicable, it should be demonstrated that free phase recovery rates have diminished to asymptotic conditions.

4.3.8.2 Suitability for Use Criteria

For excavated materials the following reuse criteria will apply:

Reuse Criteria Point	Objective	Compliance Criteria [3]
Reuse below capping layer	To ensure that concentrations of asbestos and presence of NAPL within materials proposed for reuse do not exceed agreed reuse criteria.	Composite soil samples collected at a frequency of one sample per 1,000 to 2,000m^3 of material (type dependent) proposed for re-use. Human Health - Laboratory analysis confirms concentrations of contaminants are below the criteria set out in Wood 2019 (LQM S4UL and Wood GAC). Geotechnical – Backfill in line with Highways Specification. Exact specification to be confirmed in Earthworks Specification. NAPL – Negative NAPL test by Sudan IV field screening kit.
Reuse as capping materials	To ensure that concentrations of contaminants within materials proposed for reuse do not exceed agreed reuse criteria.	

4.3.9 Management of Contaminated Soils

In order to address the identified pollutant linkage in section 2.7.1 it is proposed that remediation should be undertaken to break the pathway between the contaminants and the receptor.

This should comprise placement of protective cover layers in areas where contaminants in soils are identified above the reuse criteria. A temporary cap is to be installed to provide risk reduction prior to redevelopment when the final capping solution shall be required to be engineered into the design requirements.

4.3.9.1 Temporary Clean Cover System

In order to facilitate development the top 200mm of backfill up to the finished level of +7.3m OD, will be constructed of material validated to contain levels of contaminants below the remediation criteria including where the risk of contaminant ingestion or inhalation of vapours is considered. .

This clean cover system will be suitable as a temporary surface layer based on the remediation criteria and will be used to break the pathway to the underlying soils for a period of up to four years with minimal ongoing maintenance (light weed control, etc) requirements.

The 200mm surface layer will be resistant, as far as practicable, to erosion from vegetation and weather activity. Light maintenance of the clean cover system will be the responsibility of the Tenant once the site is handed over for construction of the development. The final, permanent clean cover system or systems will be the responsibility of the tenant and incorporated within the design of the development.

4.3.9.2 Developer Led Remedial Requirements

As part of the future developer led re-development works, a permanent cover system should be incorporated into the design and construction works. Areas of hardstanding will act as a suitable cover system however in areas of soft standing and landscaping the following permanent cover system should be incorporated into the design and installed:

- Geotextile marker layer over soils containing exceedance of the reuse criteria; and
- 450-600 mm thickness of suitable imported materials.

[3] Sampling frequency to be formalised and agreed as part of the earthworks Specification and MMP

- Suitable Engineering controls in structures as required (e.g. ground gas and vapour, concrete design).

4.3.9.3 NAPL Impacted Materials

Materials impacted with NAPL are likely to be excavated as part of the enabling earthworks. The most sustainable use of these materials is to facilitate their reuse on site and as such treatment is required to make them suitable for use such that they do not represent a potential ongoing source of contamination. The volumes of materials for treatment have been estimated at between 5-10% of the predicted soil arisings, however due to the discrete nature of these impacts, materials will potentially be generated throughout the works and in variable amounts.

The exact approach to treatment of materials impacted with NAPL will be influenced by a number of variables including volume of material, contaminant loading, contaminant properties and timescales. A number of remediation technologies are available that could technically, operationally and commercially be employed to meet the remediation objectives and make the NAPL impacted soils suitable for re use at the site, these include;

- Ex situ bioremediation;
- Stabilisation;
- Soil Washing;
- Ex situ thermal remediation (smouldering combustion or thermopile); and,
- Excavation and disposal.

Where soils are visibly impacted with NAPL or olfactory observations / onsite screening with a photoionization detector and testing with a Sudan IV NAPL screening kit indicates the presence of NAPL they shall be consigned for treatment either on site or within a wider project treatment hub until testing as defined above indicates the NAPL is no longer present. Treated soils will be validated against the remediation criteria as suitable for use prior to backfill as bulk fill.

4.3.9.4 Management of Asbestos Containing Materials

It is anticipated that there is a potential for asbestos fibres to be identified within materials excavated from the Net Zero site however, only a limited number of the historical ground investigation works have scheduled asbestos analysis and therefore it cannot be determined at this point how frequently materials are expected to contain asbestos containing materials.

During excavation works to remove underground structures there is the potential for ACM to be encountered. In the event that suspected ACM materials are observed associated with excavations, sampling will be undertaken to confirm the asbestos type and quantification. Where ACM has to be removed to facilitate removal of structures it shall be separately stockpiled and covered to control potential dust generation.

Soils containing asbestos in excess of the reuse criteria will not be subject to mechanical screening where free fibres have been detected or are suspected. All soils containing asbestos will be managed by maintaining mist sprays to keep the soils wet whilst handled and covered when stockpiled.

Soils which have been identified as containing asbestos (or suspected to) will be stockpiled separately from all other excavated materials. These materials will be characterised by sampling and laboratory analysis.

In the event that materials are impacted with visible fragments of ACM, the ACM materials shall be handpicked by a suitably licenced asbestos contractor with additional control measures implemented based on the sampling results.

Where soils containing contaminants of concern in excess of the reuse criteria and, due to the presence of asbestos cannot be safely handled or successfully treated, they will be disposed of offsite.

4.3.9.5 Management of Potentially Expansive Refractory Materials

If these materials are excavated as part of the enabling earthworks and are not comingled with other materials, they should be separated from other materials as far as practicable and stockpiled. Material

should be crushed to an acceptable material as specified in the Earthworks Specification [Arcadis 2022b] and reused in areas identified by STDC as low risk from the effects of expansive properties.

The above is intended to reduce rather than eliminate the risks from these materials. Additional management through the use of engineering controls are likely to be required depending on the final redevelopment, these are to be the responsibility of the developer.

4.3.10 Unexpected Contamination

At present, data gaps exist in areas of the site occupied by structures associated with the former Steelworks, no detailed characterisation has been undertaken in these areas of the site.

Additionally, changes to the remediation strategy may be required during the remediation works, as a result of encountering unexpected contamination[4]. Should unexpected contamination be encountered, then further characterisation and risk assessment will be undertaken as required. In this situation an addendum to the strategy will be prepared detailing how this contamination will be dealt with. Written agreement with the regulators will be required prior to implementation of any amendments to the agreed strategy. Any such amendments shall be required to be fully documented within the Verification Report.

4.3.11 Anticipated Enabling Earthworks and Remediation Extents Quantities

The extent of the enabling earthworks and remediation have been estimated based on current site information. Anticipated excavation extents are presented on Figure 1 in Section 2.13 and in Appendix A. It should be noted that these are depths from existing site levels and therefore account for land raises, stockpiles and surface features.

4.3.12 Verification of Excavations and Materials for Reuse

Materials identified for reuse will be required to be tested prior to placement to demonstrate compliance with the reuse criteria. Testing will be undertaken on a proposed frequency identified in Section 4.3.8.

4.3.13 Backfill

All Made Ground will be excavated and screened to remove oversize or deleterious material. Oversize material will be crushed for reuse, while deleterious material will be removed from site. All remaining material will be placed into stockpiles and subjected to testing and grading to ensure suitability as defined in series 600 of the Specification for Highways. Where the material does not meet the suitability criteria, it will be subjected to physical treatment, modification or stabilisation as required to achieve the necessary degree of compaction. Imported fill such as mudstone may be used if sufficient suitable site-won materials cannot be identified to meet development timescales.

No detailed redevelopment design is currently available for the site, STDC have completed a cut and fill model with development levels set at 7.3m AOD. The model [drawing TSWK-STDC-NZT-ZZ-DR-C-0005 Net Zero Teesside - Remediation Zones - Rev B] presented as Figure 1 indicates a surplus of 22,402m^3 of material following completion of the earthworks. The model is presented in Appendix A.

The Earthworks Specification should be consulted for further details 10035117-AUK-XX-XX-RP-ZZ-0420-01-Net_Zero_Earthworks.

Where required, imported materials from off site or the wider Teesworks site shall be used to fulfil any materials deficit. Imported material must be suitable for use under the MMP and this document. For each source of imported material for backfill, a material statement shall be provided detailing the chemical testing results, geotechnical testing material classification, destination of material deposition on site and proposed method of compaction. Site won materials that are re-used on site must be demonstrated as suitable for use in accordance with the MMP. Prior to backfill, excavations will be dewatered. Excavations will be backfilled in layers in accordance with the Highway Specifications.

4.3.14 Environmental Controls and Management

The Contractor shall prepare and submit a Construction Phase Environmental Management Plan (CEMP) for the Works and shall consider the following environmental aspects.

[4] This is defined as any contamination source which is distinct in its chemical or physical composition from the type of source material considered within the conceptual site model.

4.3.14.1 Surface Water Management

The Contractor shall develop and implement a surface water management plan as a component of the CEMP to provide temporary drainage facilities and protection measures (such as silt fences) as necessary to ensure the site, the Remediation Works, the adjacent land and existing facilities are adequately drained and run-off managed during the course of the Work.

The Contractor shall ensure that surface water and other water generated as part of the Works shall be monitored and treated via an appropriate water treatment system in order to meet the requirements of the Environmental Permit or Trade Effluent Discharge Consent.

This may include;

- Settlement tanks, lamella filters, sand filters or similar, to remove solids and fines from water.
- Granular Activated Carbon filtration.
- pH adjustment.
- Any further treatment necessary to effect compliance with the consent limits.

4.3.14.2 Dust, Noise and Vibration

Air Quality and Dust Management Plan

An Air Quality and Dust Management Plan (AQDMP) will be prepared as a component of the CEMP. Baseline data will be collected as part of this plan to allow the impact of the works on the surrounding environment to be determined and allow the success of control measures undertaken to protect the site workforce and neighbouring receptors to be assessed. Trigger levels for remedial action will be defined within this plan.

Dust control measures will be implemented through the works including the use of damping down, sealing of stockpiles and vehicle wash facilities to prevent the transport of mud and debris from the site onto public roads.

Asbestos

A reassurance monitoring plan and program shall be developed and implemented for asbestos air monitoring as part of the CEMP. Baseline data will be collected as part of this plan to allow the impact of the works on the surrounding environment to be determined and allow the success of control measures undertaken to protect the site workforce and neighbouring receptors to be assessed.

Noise

Prior to commencement of works on site noise data will be taken to establish baseline conditions. Trigger levels to prevent unacceptable impacts to receptors shall be identified within the CEMP and agreed with the Regulators. Noise monitoring stations will be implemented to monitor the impact of the Works against background levels and allow measures to be implemented to ensure noise levels remain below these limits.

Vibration

Prior to commencement of works on site vibration levels will be taken to establish baseline conditions. Trigger levels to prevent unacceptable impacts to receptors shall be identified within the CEMP and agreed with the regulators. The Contractor shall implement vibration monitoring stations to monitor the impact of the Works against background level and these limits.

4.3.14.3 Ecology

As discussed in Section 2.10 following the completion of the ecological surveys and review of the findings of the HRA, any control and mitigation measures identified within it shall be adopted in relations to the remediation and restoration works and future development.

5 Reporting

5.1 Pre-commencement

5.1.1 Materials Management Plans

An MMP, as detailed in Section 2.14 shall be prepared by the appointed Contractor in accordance with CL:AIRE DoWCoP and authorised by a QP registered with CL:AIRE.

5.1.2 Construction Phase Environmental Management Plan

The appointed Contractor will prepare a CEMP for the works. This will consider the potential impacts that the works will have on the environment and include any monitoring and control measures required.

The plan will set out the monitoring and recording process for the management and minimisation of waste, including the storage and transport of waste on-site. This will include a recording mechanism for required waste documentation such as Waste Transfer or Consignment Notes (dependent on the waste stream) in order to confirm the assessment of the waste impact and to implement embedded mitigation measures.

The CEMP will include their methodologies for controlling and monitoring the following aspects of the works:

- Waste Management Procedures
- Noise and vibration
- Air quality and dust management
- Any ecological mitigations required
- Surface water drainage
- Spills and environmental releases
- Monitoring and measuring procedures
- Relevant policies, legal requirements and key stakeholders

5.2 Implementation

During remediation implementation, regular meetings will be held and minuted by the remediation contractor to provide robust control of the work. Meetings are proposed to include:

- Pre-start Meeting
- Daily Site Briefings
- Weekly Site Progress Meetings
- Fortnightly Contract Review meetings
- Risk Reduction/Change Management Meetings
- Project Close Out Meeting

Data types to be collected and reviewed during the remediation implementation period are described in Section 5.3 below. Records will be produced to detail progress of the works. Should site conditions vary from those currently known, resulting in a change to the proposed remediation strategy, this will be communicated to relevant stakeholders at the earliest opportunity to allow for an amended approach to be developed and approved.

5.3 Remediation Works Verification Report

Verification of remediation will be based on a number of lines of evidence collected by the remediation contractor during the works and tracked through the implementation phase. These will be documented within the final Verification Report as follows:

5.3.1 Field records

Field records to verify the works may include the following;

- Excavation extents and depths supported by topographic survey data;
- Volumetric measures of materials excavated and removed from site;
- Field screening / onsite analysis of soil samples (delegated to validating consultant);
- Records of required backfilling and compaction processes;
- In situ geotechnical testing of reinstated material to ensure compliance with Earthworks Specification;
- Volumetric records of water and free phase hydrocarbons recovered from excavations; and,
- Photographic records (delegated to validating consultant).

5.3.2 Laboratory Results

Soil and water sampling and accredited laboratory analysis data will be provided to confirm that:

- On completion of excavations contaminant concentrations within remaining in situ soil meets the reuse criteria, as far as is reasonably practicable (laboratory results);
- Contaminant concentrations within excavated soil that may be re-used onsite as infill to excavations, meet the reuse criteria;
- Laboratory analysis of recovered groundwater / treated groundwater to support off-site disposal, re-infiltration or disposal under consent to foul drainage network;
- Laboratory analysis results of material imported onto site as backfill will be obtained to demonstrate material meets the reuse criteria;
- Geotechnical testing of reinstated material to ensure compliance with Earthworks Specification. Laboratory analysis will be undertaken by a UKAS accredited laboratory; and
- Petrology and slag expansion testing to provide indicative site conditions.

5.3.3 Topographic Survey Records and Drawings

Site drawings and topographic plans will be developed by the remediation contractor to demonstrate that:

- Source areas have been removed (if identified) and provide records of excavation extents during the Works;
- Records of below ground obstructions left in-situ following the works;
- Site levels have been restored to the agreed formation levels;
- Thickness and extent of capping layer placed on the site; and,
- Re-used materials have been located in the correct place through as-built drawings showing locations of remedial works and records of residual hazards.

5.3.4 Materials Audit Trail Records & Environmental Monitoring

The results of the monitoring and testing set out in the CEMP, including details of any spills or emergency response measures employed, will be included together with evidence to demonstrate that:

- Re-used material has been deposited in the correct location in compliance with the materials management plan;
- Waste materials have been properly quantified and have been accepted by an appropriately licenced facility include completed waste transfer documentation; and that
- Imported materials are of correct quality and volume for use on site and free of asbestos.

APPENDIX A

Figures

SITE AREA	PLOT REF	PLAN AREA (m2)	PLATFORM LEVEL (M AOD)	REMEDIATION DIG LEVEL (M AOD)	CUT FROM EXISTING GROUND TO REMEDIATION DIG LEVEL (M3)	FILL FROM EXISTING GROUND REMEDIATION DIG LEVEL (M3)	FILL FROM REMEDIATION DIG LEVEL TO PLATFORM LEVEL (M3)	NET (M3)	SURPLUS CUT/DEFICIT FILL	TOTAL (M3)
NZT OPTION 1 FGL 7.3M AOD	NZT GREEN	200,225	7.3	4.8	525,691	0	500,563	25,129	SURPLUS CUT	**4,691**
	NZT ORANGE	99,651	7.3	4.8	186,236	2,458	249,128	-65,350	DEFICIT FILL	
	NZT PINK	91,513	7.3	3.8	365,207	0	320,296	44,912	SURPLUS CUT	
				TOTALS	**1,077,134**	2,458	**1,069,986**			
	NZT VOID ALLOWANCE	391,389	-	-	0	0	36536	-36,536	DEFICIT FILL	-36,536
	NZT GREY	271,238	0.2m SCRAPE	0.2	54,248	0	0	54,248	SURPLUS CUT	**54,248**
									TOTAL	**22,402**

Millimetres 100 10 0

DO NOT SCALE

NOTES

1. DO NOT SCALE FROM THIS DRAWING
2. IN ALL AREAS, PARTICULARLY THE GREEN AND PINK SHADED AREAS, THERE IS A FIRM LIKELIHOOD THAT EXCAVATION WILL NEED TO BE ADVANCED TO GREATER DEPTHS LOCALLY TO REMOVE CERTAIN BURIED STRUCTURES/FEATURES AND/OR TO ADDRESS THE REMOVAL OF CONTAMINATED SOILS

KEY

NZT SITE DEVELOPMENT BOUNDARY, INCLUSIVE OF TEMPORARY CONSTRUCTION LAYDOWN AREA.

THIS FORMS THE ENVELOPE OF THE REMEDIATION WORKS CONTRACT, EXCLUSIVE OF NOMINAL OVER DIG AT ONE OR MORE OF THE BOUNDARIES AND AREAS EXTERNAL TO THIS SITE THAT MAY BE ASSIGNED FOR MATERIALS PROCESSING

THE PROPOSED FINISHED GROUND LEVEL FOR THE REMEDIATION WORKS IS 7.3 AOD

REQUIRED MINIMUM EXCAVATION DEPTH IS 2.5m BELOW THE PROPOSED FINISHED REMEDIATION WORKS LEVEL, i.e., 4.8m AOD

REQUIRED MINIMUM EXCAVATION DEPTH IS 3.5m BELOW THE PROPOSED FINISHED REMEDIATION WORKS LEVEL, i.e., 3.8m AOD

REQUIRED GROUND REMEDIATION WORKS WILL TYPICALLY INVOLVE A LIMITED PROGRAMME OF EXCAVATION AND FILLING (TO SHALLOWER DEPTHS THAN THE AREAS SHADED GREEN AND PINK), WITH THE NEED TO REMOVE BURIED RELIC FOUNDATIONS AND SIMILAR BEING MORE SELECTIVE.

WORKS TO THIS AREA MAY ALSO INCLUDE FILLING UTILISING RESIDUAL MATERIALS FROM THE GREEN, PINK AND GREY SHADED AREAS.

THIS IS THE PROPOSED CONSTRUCTION LAYDOWN AREA FOR THE FOLLOW-ON NZT PROJECT, THAT WILL BE ACCESSED, IN PART, POTENTIALLY FROM JULY 2023, WITH OCCUPANCY INCREASING TO THE END OF 2023.

THE REQUIRED GROUND REMEDIATION WORKS WILL LARGELY BE CONTAINED TO SITE CLEARANCE, A SURFACE SCRAPE, AND A GENERAL, RELATIVELY MINOR CUT/FILL LEVELING OF THE AREA, FOLLOWING WHICH, THE AREA MAY BE CAPPED WITH GRANULAR FINISHING LAYER.

THIS DRAWING HAS BEEN PRODUCED WITH REFERENCE TO THIRD PARTY RECORDS, EVERY EFFORT HAS BEEN MADE TO PRESENT THE INFORMATION ACCURATELY. HOWEVER BEFORE GROUND BREAKING, APPROPRIATE MEASURES MUST BE TAKEN TO ENSURE THE LOCATIONS OF THE BURIED SERVICES.

FOR INFORMATION

Rev.	Date	Description	By	Chk'd	App'd
B	21.02.22	VOLUMES UPDATED	LCD	LCD	JMC
A	15.02.22	FIRST ISSUE	KW	LCD	JMC

STDC
Teesside Management Offices,
Redcar, TS10 5QW
www.southteesdc.com

South Tees Development Corporation

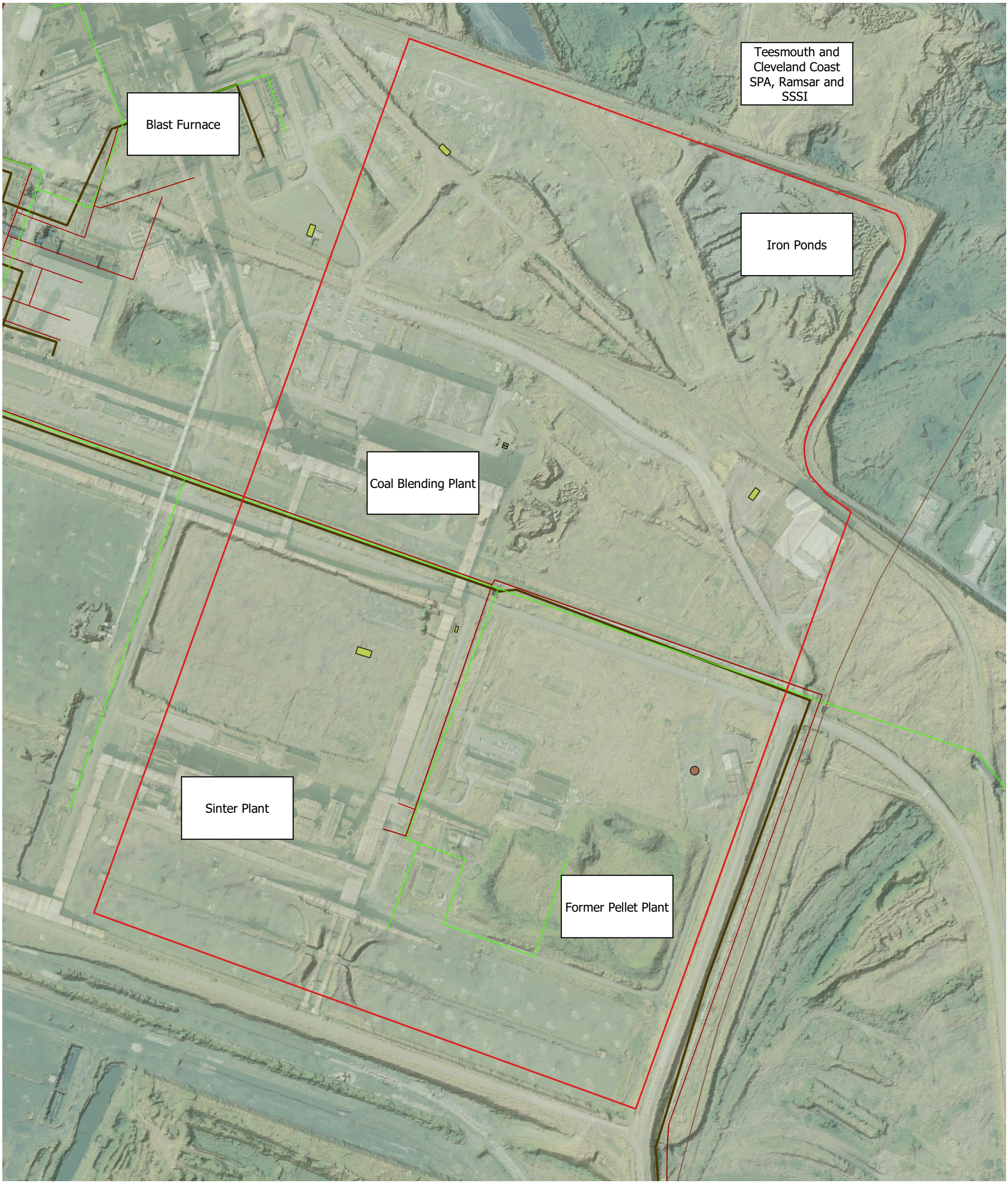
Project Title:

TEESWORKS
The UK's largest industrial zone

Drawing Name:

NET ZERO TEESSIDE OUTPUT FOR REMEDIATION STRATEGY/MMP

Drawn by: KW	Date: FEB 2022
Checked by: LCD	Date: FEB 2022
Approved by: JMc	Date: FEB 2022
Drawing Number: TSWK-STDC-NZT-ZZ-DR-C-0005	Revision: B
Drawing Scale: 1:2000	Page Size: A1



Legend

Utilities STDC Data

TSWK-STDC-ZZZ-ZZ-M2-CU-0004

- CokeOvenGasAboveGround_Cleaned
- RWLFoul_FormerCessPit
- Industry water
- AreaWorkshops_GasOilTank
- FuelOil
- CATPipeline
- RWLFoul_CessPit_SepticTank
- CokeOvenGasAboveGround

Drawings

Net Zero

- STDC_Remediation_Boundary

Bing Mapping

Lidar Data

- -2.5
- 7.0
- 16
- 25
- 35

Notes:

CONTACT ARCADIS IN CASE OF ANY QUERIES.

Not all utilities shown

N

Title: Net Zero Site Setting

Site: Teesworks - Net Zero Site

Client:
South Tees Developement Corporation

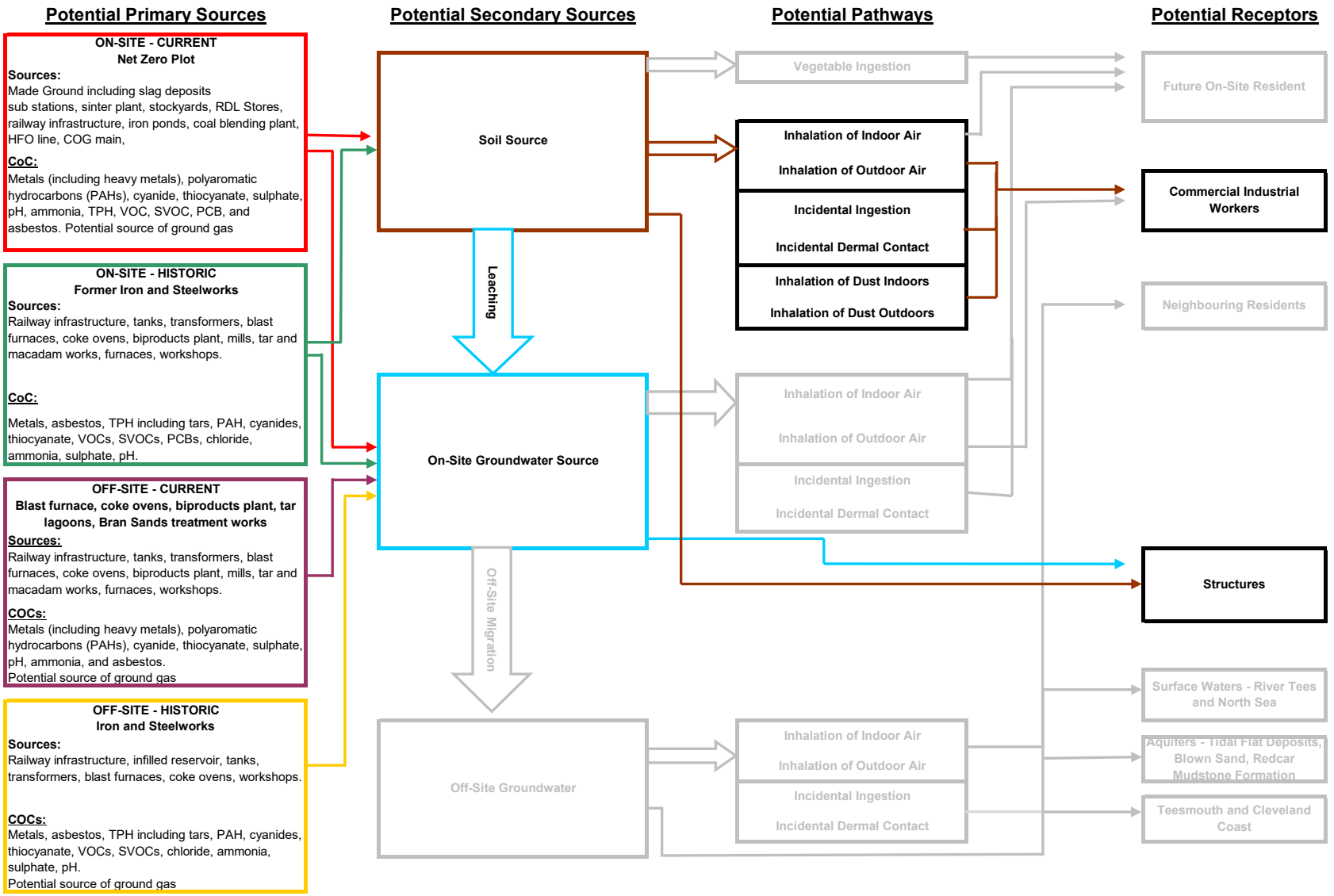
Project:
37774100

Figure 2

Date: 15/11/2021
Drawn By: JALM
DRG No: 110035117-AUK-XX-XX-DR-ZZ-0421-01-Net_Zero_Setting

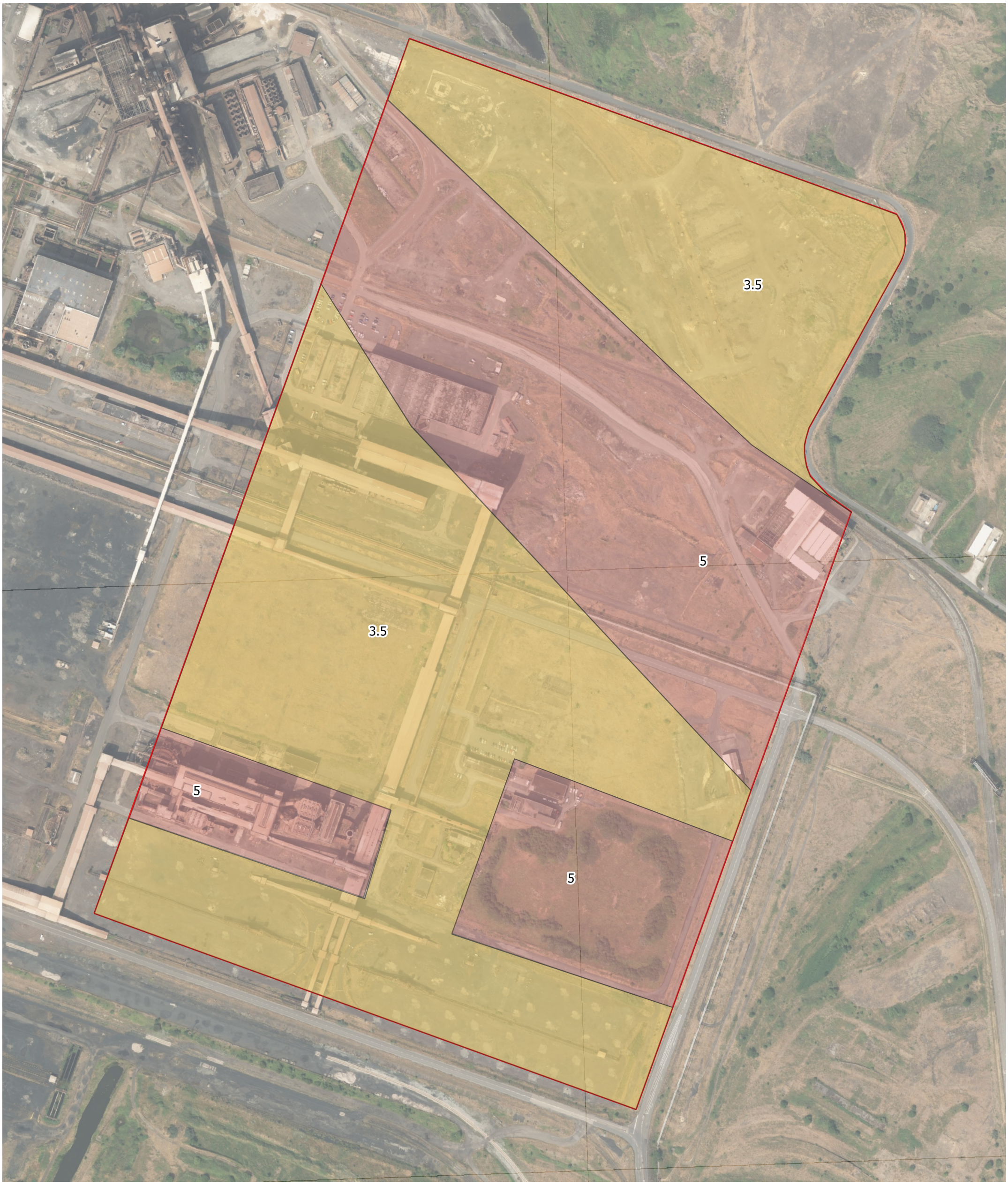
ARCADIS Design & Consultancy for natural and built assets

Outline Conceptual Site Model - Commercial Industrial End Use



Key: Pollutant linkage not considered to present a significant level of risk

ARCADIS Design & Consultancy for natural and built assets



Legend

Remediation Excavations

Bing Mapping

Maximum Depth (mbgl)

- 3.5
- 5

Drawings

- STDC_Remediation_Boundary

Notes:

CONTACT ARCADIS IN CASE OF ANY QUERIES.

Dig depths are calculated to give maximum flexibility under planning and should not be considered part of the STDC landlord specification, or to infer any contractual requirement.

N

Title: Net Zero Site Maximum Excavation Depth Plan (Curent Site Levels)

Site: Teesworks - Net Zero Site

Client:
South Tees Developement Corporation

Project:
37774100

Figure 4

Date: 15/11/2021
Drawn By: JALM
DRG No: 10035117-AUK-XX-XX-DR-ZZ-0422-03-Net_Zero_Rem_Ex

ARCADIS Design & Consultancy for natural and built assets

APPENDIX B

Study Limitations

IMPORTANT: This section should be read before reliance is placed on any of the information, opinions, advice, recommendations or conclusions contained in this report.

1. This report has been prepared by Arcadis UK Ltd (Arcadis), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with **STDC** (the 'Client'). Arcadis does not accept responsibility for any matters outside the agreed scope.

2. This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing.

3. Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Arcadis are unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have unpublished, more stringent objectives. Further work may be required by these parties.

4. All work carried out in preparing this report has used, and is based on, Arcadis' professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice, pending changes in legislation, of which Arcadis is aware, have been considered. Following delivery of the report, Arcadis have no obligation to advise the Client or any other party of such changes or their repercussions.

5. This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.

6. Whilst this report and the opinions made are correct to the best of Arcadis' belief, Arcadis cannot guarantee the accuracy or completeness of any information provided by third parties.

7. This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have been received.

8. This report refers, within the limitations stated, to the condition of the Site at the time of the inspections. No warranty is given as to the possibility of changes in the condition of the Site since the time of the investigation.

9. The content of this report represents the professional opinion of experienced environmental consultants. Arcadis does not provide specialist legal or other professional advice. The advice of other professionals may be required.

10. Where intrusive investigation techniques have been employed they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. In some cases the investigation is further limited by site operations, underground obstructions and above ground structures. Unless otherwise stated, areas beyond the boundary of the site have not been investigated.

11. If below ground intrusive investigations have been conducted as part of the scope, service tracing for safe location of exploratory holes has been carried out. The location of underground services shown on any drawing in this report has been determined by visual observations and electromagnetic techniques. No guarantee can be given that all services have been identified. Additional services, structures or other below ground obstructions, not indicated on the drawing, may be present on Site.

12. Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issue

APPENDIX C

Screening Criteria

STDC Net Zero Screening Criteria

Contaminant of Concern	Units	Human Health (Commercial Worker)	GAC Source
Metals			
Arsenic	mg/kg	640	S4UL
Boron, Water Soluble	mg/kg	240,000	S4UL
Cadmium	mg/kg	190	S4UL
Chromium	mg/kg	8,600	S4UL
Chromium, Hexavalent	mg/kg	33	S4UL
Copper	mg/kg	68,000	S4UL
Lead	mg/kg	2,300	C4SL
Mercury	mg/kg	*58**	S4UL
Nickel	mg/kg	980	S4UL
Vanadium	mg/kg	9,000	S4UL
Zinc	mg/kg	730,000	S4UL
Cyanide, Free	mg/kg	66	DQRA
Thiocyanate	mg/kg	230	USEPA
Phenol - Monohydric	mg/kg	760	S4UL
PAHs			
Naphthalene	mg/kg	*1,900*	Wood
Acenaphthylene	mg/kg	*83000***	S4UL
Acenaphthene	mg/kg	*84000***	S4UL
Fluorene	mg/kg	*63000***	S4UL
Phenanthrene	mg/kg	22,000	S4UL
Anthracene	mg/kg	520,000	S4UL
Fluoranthene	mg/kg	23,000	S4UL
Pyrene	mg/kg	54,000	S4UL
Benzo(a)anthracene	mg/kg	170	S4UL
Chrysene	mg/kg	350	S4UL
Benzo(b)fluoranthene	mg/kg	44	S4UL
Benzo(k)fluoranthene	mg/kg	1,200	S4UL
Benzo(a)pyrene	mg/kg	77	Wood
Indeno(1,2,3-c,d)pyrene	mg/kg	500	S4UL
Dibenzo(a,h)anthracene	mg/kg	3.5	S4UL
Benzo(g,h,i)perylene	mg/kg	3,900	S4UL
PAH - USEPA 16, Total	mg/kg	na	
Petroleum Hydrocarbons			
Aromatic C5-C7	mg/kg	*26000***	S4UL
Aromatic C7-C8	mg/kg	*56000***	S4UL
Aromatic C8-C10	mg/kg	*3500***	S4UL
Aromatic C10-C12	mg/kg	*16000***	S4UL
Aromatic C12-C16	mg/kg	*36000***	S4UL
Aromatic C16-C21	mg/kg	28,000	S4UL
Aromatic C21-C35	mg/kg	28,000	S4UL
Aromatic C35-C44	mg/kg	na	
Aliphatic C5-C6	mg/kg	*3200***	S4UL
Aliphatic C6-C8	mg/kg	*7800***	S4UL
Aliphatic C8-C10	mg/kg	*2000***	S4UL
Aliphatic C10-C12	mg/kg	*9700***	S4UL
Aliphatic C12-C16	mg/kg	*59000***	S4UL
Aliphatic C16-C35	mg/kg	1,600,000	S4UL
Aliphatic C35-C44	mg/kg	1,600,000	S4UL
Asbestos			
Asbestos	n/a	0.001	Arcadis

STDC Net Zero Screening Criteria

Contaminant of Concern	Units	Human Health (Commercial Worker)	GAC Source
Volatiles			
MTBE	mg/kg	210	USEPA
Benzene	mg/kg	27	S4UL
Toluene	mg/kg	56,000	S4UL
Ethylbenzene	mg/kg	5,700	S4UL
m & p-Xylene	mg/kg	5,900	S4UL
o-Xylene	mg/kg	6,600	S4UL
Vinyl chloride	mg/kg	0.059	S4UL
1,1-Dichloroethene	mg/kg	1,000	USEPA
Trans-1,2-Dichloroethene	mg/kg	23,000	USEPA
1,1-Dichloroethane	mg/kg	16	USEPA
Cis-1,2-Dichloroethene	mg/kg	2,300	USEPA
Bromochloromethane	mg/kg	630	USEPA
Chloroform	mg/kg	99	S4UL
1,1,1-Trichloroethane	mg/kg	660	S4UL
Carbon tetrachloride	mg/kg	2.9	S4UL
1,2-Dichloroethane	mg/kg	0.67	S4UL
Trichloroethene	mg/kg	1.2	S4UL
1,2-Dichloropropane	mg/kg	11	USEPA
Dibromomethane	mg/kg	99	USEPA
Bromodichloromethane	mg/kg	1.3	USEPA
cis-1,3-Dichloro-1-propene	mg/kg	8.2	USEPA
trans-1,3-Dichloro-1-propene	mg/kg	8.2	USEPA
1,1,2-Trichloroethane	mg/kg	5	USEPA
Tetrachloroethene	mg/kg	19	S4UL
1,3-Dichloropropane	mg/kg	23,000	USEPA
Dibromochloromethane	mg/kg	39	USEPA
1,2-Dibromoethane	mg/kg	0.16	USEPA
Chlorobenzene	mg/kg	56	S4UL
1,1,1,2-Tetrachloroethane	mg/kg	110	S4UL
Styrene	mg/kg	35,000	USEPA
Tribromomethane	mg/kg	86	USEPA
Bromobenzene	mg/kg	1,800	USEPA
1,1,2,2-Tetrachloroethane	mg/kg	270	S4UL
1,2,3-Trichloropropane	mg/kg	0.11	USEPA
2-Chlorotoluene	mg/kg	23,000	USEPA
4-Chlorotoluene	mg/kg	23,000	USEPA
1,3,5-Trimethylbenzene	mg/kg	1,500	USEPA
tert-Butylbenzene	mg/kg	120,000	USEPA
1,2,4-Trimethylbenzene	mg/kg	1,800	USEPA
sec-Butylbenzene	mg/kg	120,000	USEPA
1,3-Dichlorobenzene	mg/kg	30	S4UL
1,4-Dichlorobenzene	mg/kg	4,400	S4UL
1,2-Dichlorobenzene	mg/kg	2,000	S4UL
Butylbenzene	mg/kg	58,000	USEPA
1,2-Dibromo-3-chloropropane	mg/kg	0.064	USEPA
1,2,4-Trichlorobenzene	mg/kg	220	S4UL
Hexachloro-1,3-butadiene	mg/kg	31	S4UL
1,2,3-Trichlorobenzene	mg/kg	102	S4UL

STDC Net Zero Screening Criteria

Contaminant of Concern	Units	Human Health (Commercial Worker)	GAC Source
Semi-volatiles			
Phenol	mg/kg	760	S4UL
1,3-Dichlorobenzene	mg/kg	30	S4UL
1,4-Dichlorobenzene	mg/kg	4400 [f](224)[vap]	S4UL
1,2-Dichlorobenzene	mg/kg	2000 (571)[sol]	S4UL
3&4-Methylphenol	mg/kg	82,000	USEPA
2,4-Dimethylphenol	mg/kg	16,000	USEPA
2,4-Dichlorophenol	mg/kg	2,500	USEPA
1,2,4-Trichlorobenzene	mg/kg	110	USEPA
4-Chloro-3-methylphenol	mg/kg	82,000	USEPA
2-Methylnaphthalene	mg/kg	3,000	USEPA
Hexachlorocyclopentadiene	mg/kg	7.5	USEPA
2,4,6-Trichlorophenol	mg/kg	210	USEPA
2,4,5-Trichlorophenol	mg/kg	82,000	USEPA
2-Chloronaphthalene	mg/kg	60,000	USEPA
2-Nitroaniline	mg/kg	8,000	USEPA
2,6-Dinitrotoluene	mg/kg	1.5	USEPA
2,4-Dinitrotoluene	mg/kg	7.4	USEPA
Dibenzofuran	mg/kg	1,000	USEPA
Diethyl phthalate	mg/kg	660,000	USEPA
4-Nitroaniline	mg/kg	110	USEPA
Azobenzene	mg/kg	26	USEPA
Hexachlorobenzene	mg/kg	110	S4UL
Pentachlorophenol	mg/kg	400	S4UL
Butylbenzyl phthalate	mg/kg	1,200	USEPA
Bis(2-ethylhexyl)phthalate	mg/kg	160	USEPA
Di-n-octyl phthalate	mg/kg	8,200	USEPA

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