# METALS RECOVERY PROCESSING AREA, FORMER STEELWORKS, REDCAR

## Shallow Soils Remediation Options Appraisal and Remediation Strategy Report

South Tees Development Corporation

REPORT NO. 10035117-AUK-XX-XX-RP-ZZ-0181-MPA_ROA and Strategy

OCTOBER 2020

# CONTACTS

**NEIL THURSTON**
**Project Manager**

dd 01132 845300
m 07870 572824
e Neil.Thurston@arcadis.com

Arcadis.
One Whitehall Riverside
Leeds LS1 4BN
United Kingdom

Metals Recovery Processing Area, Former Steelworks, Redcar

Remediation Options Appraisal and Remediation Strategy Report

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|---|---|
| Author | Adam Bethell |
| Checker | Jonathan Miles |
| Approver | Chris Piddington |
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# 1 INTRODUCTION

## 1.1 Project Aims and Objectives

The Metals Recovery Processing Area (MRA) (the site) is a land parcel situated at the Former Redcar Steelworks located within the Redcar, Lackenby, Grangetown and South Bank conurbations of the Borough of Redcar & Cleveland, within the industrial area generally known as 'South Tees'. Figure 1 in Appendix A provides details of the site location.

The "South Tees Regeneration Master Plan" dated November 2019 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 MRA as being located within the South Bank Zone. The site is a priority development area and Arcadis understands this report is to be used within a detailed planning application (R/2020/0465/FFM) for *"Demolition of existing buildings/ structures and engineering operations associated with ground remediation and preparation of land for development".* Planning approval R/2019/0427/FFM is also in place covering the site, this is for *"Demolition of structures and engineering operations associated with ground preparation and temporary storage of soils and its final use in the remediation and preparation of land for regeneration and development".*

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. As technical consultant, the specific objectives of this phase of works were to review the output of the environmental and geotechnical risk assessment and identify applicable remediation options for the site.

## 1.2 Contract Details

Arcadis (UK) Limited (Arcadis) were appointed by South Tees Development Corporation (STDC) to conduct a remediation options appraisal and develop a remediation strategy to address environmental constraints relating to shallow soil ground conditions identified by the physical ground investigation works conducted at the Metals Recovery Processing Area site.

The scope of works was defined by Arcadis, on behalf of STDC, as presented in "Metals Recovery Area – PM and Technical Support (updated)" dated 1st July 2020. At the request of STDC the investigation was split into two phases, an initial investigation of shallow soils (this phase) and a subsequent investigation of deeper soils and groundwater to be conducted when further certainty on redevelopment scenarios has been confirmed.

Figure 1 in Appendix A provides details of the facility location.

## 1.3 Report Aims

The aim of this remediation options appraisal (ROA) and strategy document is to use the available information to assess feasible remediation strategies to address the active shallow soil source-pathway-receptor linkages identified by the site condition report and the development constraints identified by the geotechnical risk assessment within the conceptual site model (CSM) for the contract area in order to develop the final remediation technology selection and design. The shallow soils remediation strategy has been formulated to support the planning process for the development of the Metals Recovery Processing Area site.

## 1.4 Previous Information

No specific Phase I Environmental Site Assessment (ESA) exists for the site. However, the northern portion of the site is covered by the following document supplied by STDC:

- TS4 South Bank – Phase 1 Geo-Environmental Desk Study, prepared by CH2M Hill for the Homes and Communities Agency, report ref. 678079_TS4_002 dated August 2017 and marked Final.

The site is also considered in:

- South Industrial Zone ES - Vol 2 - Chapter H (Ground Conditions and Remediation), prepared by Arcadis for STDC and dated July 2020.

In addition, STDC also supplied the following documents:

- 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]
- Metals Recovery Site Ecological Impact Assessment and Biodiversity Net Gain Assessment Job number 276320-00 by ARUP date 14 August 2020
- Arcadis, The Former Steelworks Redcar: Metals Processing Areas, Shallow Soils Environmental Site Assessment Report 10035117-AUK-XX-XX-RP-ZZ-0125-02-MRA_Shallow_Soils, dated August 2020.
- Former Steelworks land, South Tees – Flood Risk Assessment and Drainage Strategy, Prepared for South Tees Development Corporation by Wood, Ref. 41825-WOOD-XX-XX-RP-OW-0001_A_PO1, dated 25th June 2019.

This ROA and 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 or 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 Location

The MPA is located in the south west of the Former Redcar Steelworks and is bound by land occupied by MGT Teesside to the north, the Lackenby Channel and PD Ports to the east, the SLEMs and Cleveland Channel to the South and the wider south bank site to the west. The site elevation generally ranges from approximately 7m to 12m above Ordnance Datum (AOD) with the exception of the viewing platform which is approximately 20-25m AOD.

The centre of site is located at National Grid Reference: 454600, 522600; and an indicative post code for the site is TS10 5QW.

A Site Location Plan is presented on Figure 1 within Appendix A.

## 2.2 Site Description

The site is approximately 21.5 hectares in size and approximately rectangular in shape, tapering to the south. The southern boundary is marked by a rapid change in level to the Cleveland Channel (approx. 2 to 3m AOD) with the SLEMs facility beyond. The Cleveland Channel discharges into the Lackenby Channel which runs parallel to the eastern boundary of the site. Both the Cleveland and Lackenby channels are tidal and discharge into the River Tees a short distance north of the site.

PD Ports facilities are located to the east (beyond the Lackenby Channel) and include a utility corridor, port buildings and wharf facilities. The area north of the site is currently under development as a biomass power station operated by MGT Teesside. A third-party landfill (land rise) Highfield Environmental is located to the east of the site, the landfill is understood to accept wastes types including domestic and special.

At the time of the siteworks the site is covered by stockpiles of aggregates from the steelmaking process, which are being processed by a contractor. There are infrequent concrete structures including a large viewing platform in the centre of the site, south of which are four buildings. With the exception of the viewing platform and the stockpiles the area is generally level and covered with aggregates of steel biproducts.

## 2.3 Geology

Review of the British Geological Survey (BGS) data suggests that the site is directly underlain by reclaimed madeground deposits. Below the madeground deposits the majority of the site is underlain by Tidal Flat Deposits predominantly comprising sand and clay. This is anticipated to be underlain by Glaciolacustrine Deposits and Glacial Till based on data from historic boreholes in the vicinity of the MPA.

Bedrock beneath the site is anticipated to comprise Mercia Mudstone. Excerpts from the BGS mapping data are presented as Figure 2 below and in Appendix A.

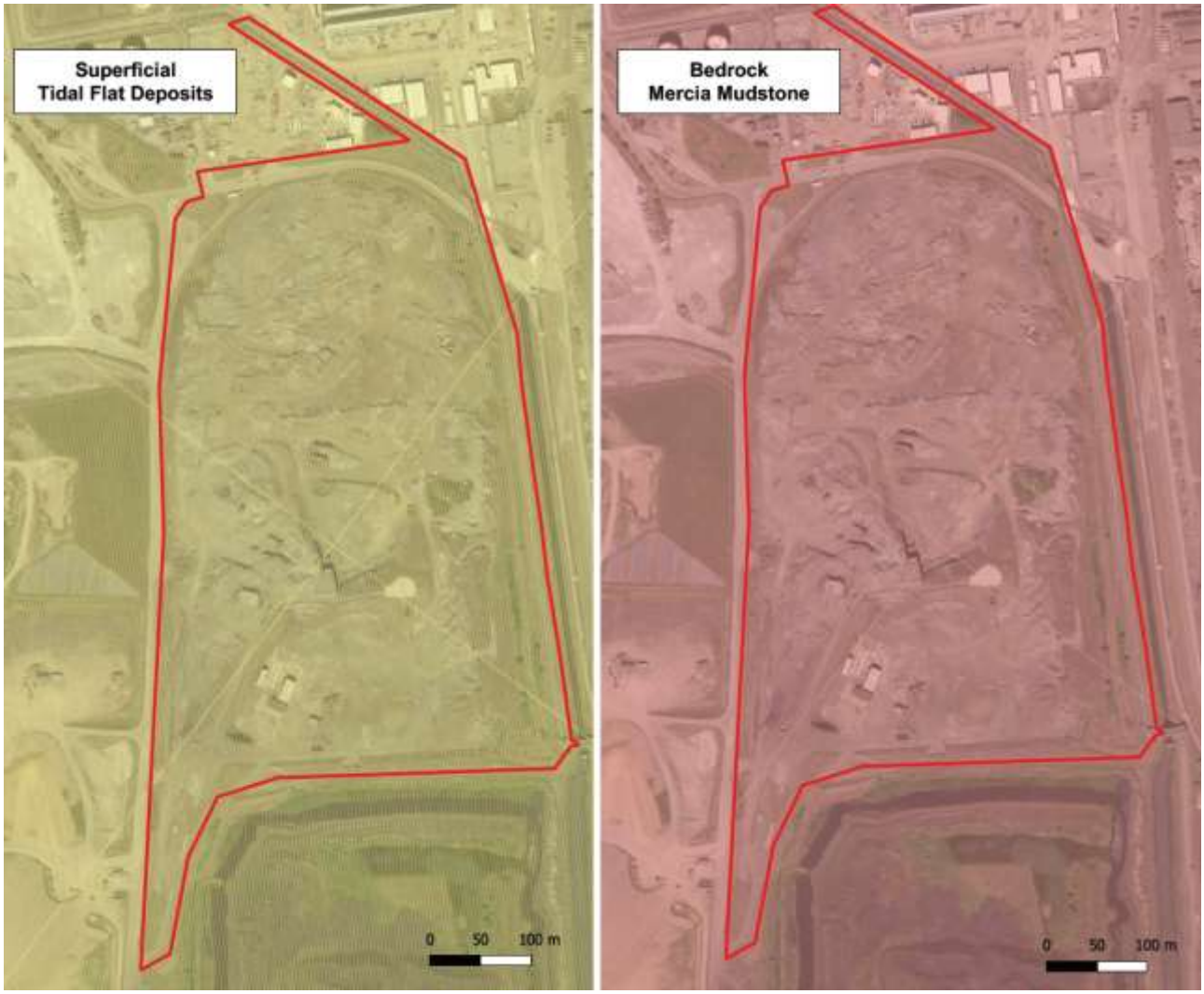



Figure 2: Excerpts from BGS Mapping

The following table provides an overview of the site-specific geology encountered during the investigation across the site.

| Interpreted Unit | Minimum Basal Depth (m bgl) | Maximum Basal Depth (m bgl) | Comment |
|---|---|---|---|
| Made Ground | >4.5 | >4.5 (base not proved at majority of locations) | Site surfacing comprised a grey aggregate of slightly sandy gravel of slag.<br>The Made Ground in all locations with the exception of MPA_AUK_TP102 comprised slag rich deposits which contained 75 – 100% recovered as gravel and cobbles and varying quantities of ash, and clinker. Slag was vesicular and noted to be predominantly grey but with green, brown, purple and white colouration and or precipitates on the surface. Occasional iron rich deposits were also noted on the slag. Fragments of concrete and metal were noted within the deposits.<br>The slag deposits were well bound and potentially partially fused across the Made Ground which required significant effort to excavate.<br>More humic material was noted at the surface in MPA_AUK_TP102, underlain by slag rich deposits and a concrete slab obstruction. |
| Tidal Flat Deposits (Secondary A Aquifer) | N/A | N/A | Not encountered |
| Glaciolacustrine Deposits | N/A | N/A | Not encountered |
| Glacial Till | N/A | N/A | Not encountered |
| Mercia Mudstone (Secondary (B) Aquifer) | N/A | N/A | Not encountered |

Made Ground was encountered in all intrusive locations and proven to a thickness of up to 4.5m. The base of the Made Ground was not proven in any of the 31 trial pits, therefore, greater thickness of made ground material exists across the site.

Two types of Made Ground were noted:

- **Slag-dominant material:** Generally ranging from gravel to boulder size fragments of slag. 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 blue, brown, green, and purple. Discolouration of the slag surface was also noted with white crystallisation/discolouration often noted on the outer surface along with occasional iron rich areas. Slag is estimated to comprise 75 - 100% of the soil matrix, weighted towards the latter.
- **Granular Made Ground:** Layers of granular made ground were identified in 5 locations only (MPA_AUK_TP101, MPA_AUK_TP110, MPA_AUK_TP119, MPA_AUK_TP127, and MPA_AUK_TP128) and was described as a sandy fine to coarse gravel with many cobbles. The gravel and cobbles included brick, concrete, wood and other demolition materials, slag was not the dominant constituent although often still present within these layers. Although the granular made ground layers were present in the locations listed above the pits, the dominate material type in the trial pit was slag materials.

## 2.4 Hydrogeology

Groundwater was not encountered during the investigation. The hydrogeological map for the area (Sheet 1: Hydrogeological Map of England and Wales, 1:625,000 scale) indicates that groundwater beneath the site within the Mercia Mudstone Formation is at an elevation of approximately 0m AOD with groundwater elevation contours indicating a flow to the north. The site is not located within a Groundwater Source Protection Zone and given the proximity to the Tees Estuary groundwater is likely to be tidally influenced and potentially subject to saline intrusion.

## 2.5 Hydrology

The closest surface water features to the site are the Cleveland Channel which forms the southern boundary of the site and the Lackenby Channel which is located approximately 40m to the east of the site. The Cleveland Channel flows into the Tees via the Lackenby Channel. Both the Cleveland and Lackenby channels are tidally influenced.

## 2.6 Contaminant Distribution in Shallow Soils

The extent of contamination in the shallow soils is summarised below based on the findings of the Generic Qualitative Risk Assessment (GQRA) completed as part of the ESA. Given the size of the site, the sampling was conducted (as far as practical given surface obstructions) on a grid to provide an appropriate level of resolution of contaminant distribution for risk assessment and remediation design purposes.

During the implementation of any remediation approach additional testing is likely to be required to refine the contaminant distribution and maximise the efficiency of remediation implementation.

### 2.6.1 Human Health

Asbestos in shallow soils

A total of 32No. samples were screened by polarised light microscopy in accordance with HSG248 for the presence of asbestos (HSE, 2005). In 3No. samples asbestos was detected as bundles of fibres (chrysotile). The detections were recorded in MPA_AUK_TP101 (0.003% by mass), MPA_AUK_TP102A (0.002% by mass), and MPA_AUK_TP130 (0.002% by mass) at depths of 3.5, 1.0 and 0.6 metres below ground level (m bgl) respectively. The samples from MPA_AUK_TP101 and MPA_AUK_TP130 are noted to be within deposits containing demolition material, whilst the sample from MPA_AUK_TP102A is a very slag rich deposit. In pit MPA_AUK_TP130 similar material is encountered to the surface.

Asbestos was identified in approximately 9% of samples. The asbestos distribution across the site is shown on Figure 3 within Appendix A and is not localised in particular areas

Organic Contaminants in shallow soils

None of concentrations of CoC measured in the 32 shallow soils samples were in excess of the soil GAC for the contaminants for which screening criteria are available, therefore there is not considered to be a significant risk to human health from these CoC in shallow soils.

### 2.6.2 Controlled Waters

Several exceedances of Water Quality Standards (WQS) were recorded in soil leachate samples from Made Ground. As assessment of groundwater and surface water quality has not been conducted at this stage the significance of the potential pollutant linkages identified for Controlled Waters cannot be assessed.

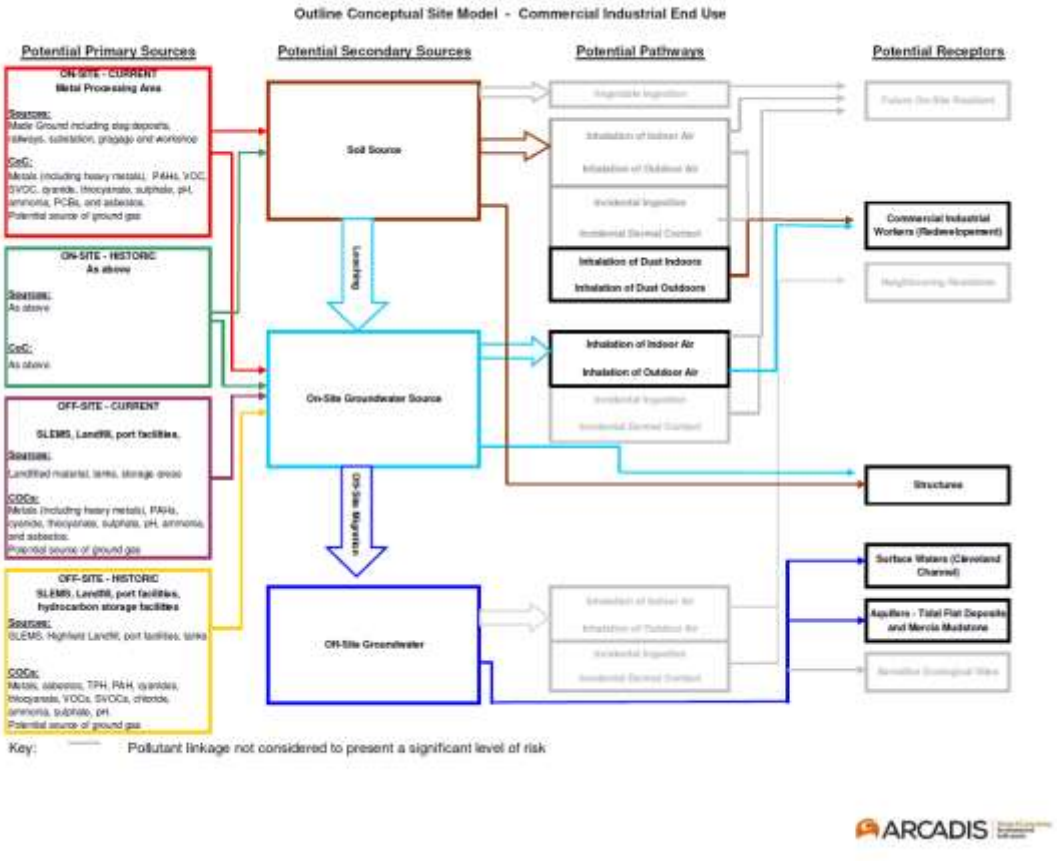
## 2.7 Conceptual Site Model

### 2.7.1 Environmental

The ESA for shallow soils developed a conceptual site model (CSM) 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 screening criteria. The identified SPR linkages were:

- Human Health - Risk to commercial workers via inhalation of asbestos fibres, originated from shallow Made Ground across the site.
- Water Resources –The groundwater at the site has not at the time of writing been investigated. Therefore the potential SPR linkages associated are shown as potentially active.

The identified SPR linkages for the site are shown within the CSM presented below and as Figure 4 in Appendix A.




## 2.7.2 Ground Gas

The ESA for shallow soils did not assess the risks to human health or built receptors posed by potential accumulations of ground gas. Ground gas assessment shall form part of the Environmental Site Assessment of the deep soils and groundwater at the Metal Recovery Processing Area.

## 2.7.3 Geotechnical

It is not the specific intention of this ROA to address geotechnical risks however these works have identified the following 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;
- Potential collapse or inundation settlement as a result of surface water infiltration and groundwater movement;

- Sulphate attack on subsurface concrete; and,
- Obstructions within the made ground (boulder size fragments of slag and buried underground structures);

## 2.8 Unexploded Ordnance and Magnetic Anomalies

Desktop Unexploded Ordnance (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, magnetic anomalies have been encountered elsewhere on STDC landholdings which may represent potential UXO risk. 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. There is anecdotal evidence of anti-aircraft emplacement being present on the site. It is understood archaeological watching brief will be deployed when works are completed in the identified areas which may lead to development constraints being present in that areas of the site.

## 2.10 Ecology

An Ecological Impact Assessment and Biodiversity Net Gain Assessment was undertaken by ARUP (August 2020). It identified that there are a number of designated ecological site in close proximity to the Metals Recovery Processing Site namely the Teesmouth and Cleveland Coast SPA (250m) and The Teesmouth and Cleveland Coast Ramsar (1.3km north-west).

The Ecological Impact Assessment identified a number of breeding and wintering bird species most notably the Shelduck. Ecological oversight and mitigation shall be required to ensure that no significant residual effects upon ecological features are anticipated.

### 2.10.1 Invasive / non-native species

The Ecological Impact Assessment and Biodiversity Net Gain Assessment (ARUP 2020) did not record any invasive species within the Metals Recovery Processing Area site, however, there is the potential for invasive species to be present or to colonise the area.

The Ecological Impact Assessment and Biodiversity Net Gain Assessment (ARUP 2020) document should be reviewed to develop an appropriate mitigation and management strategy.

## 2.11 Proposed Redevelopment and Enabling Works

No detailed redevelopment design is currently available for the site, however a development platform is planned to be created at +8.8m OD. Arcadis understand STDC are to complete enabling works to create an environmentally suitable development platform for future redevelopment. These works will entail turnover of the Made Ground to a depth of up to a maximum of 2.5m below final level (+6.3m OD), including removal and crushing of relic structures and obstructions, removal and treatment of environmental contamination as required and replacement of processed or treated material to formation levels for development. Where current site levels are below the +6.3m OD turnover zone no works are proposed to be undertaken.

In some areas of the Site relic structures are expected, where these or identified environmental contamination extend below 2.5m bgl, any requirement for deeper excavation works will be assessed on a case specific basis following consultation with relevant stakeholders.

The preparation of a geotechnically suitable development platform for a specific redevelopment is the responsibility of the developer.

This ROA has been conducted 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 similar brownfield sites. The site is part of a wider STDC landholding and Arcadis recommends the remediation approach to the Metal Recovery Processing Area is considered holistically with the wider redevelopment of the landholding.

## 2.12 Materials Management

Given that remediation measures may involve the movement of materials around the Metals Recovery Processing Area and 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.

### 2.12.1 Achieving Non-Waste Status

There are several different waste regulatory options available, the suitability of which is dependent upon the complexity of the site, previous permitted activities and the quantity/composition of the material to be reused. It has been concluded the two potential options are

1. Via an application in accordance with CL:AIRE guidance 'Definition of Waste: Development Industry Code of Practice' (DoWCoP).
2. Via Waste Recovery Permit (WRP) under the Environmental Permitting (England and Wales) Regulations 2016 SI2016/11542 ("the EPR")

The route to achieving a suitable non waste status must be selected in consultation with the Environment Agency and in accordance with the status of the materials under the Environmental Permitting Regulation. An overview to the two options are included below.

#### 2.12.1.1 Definition of Waste: Development Industry Code of Practice

The Environment Agency (EA) has worked with industry through CL:AIRE to prepare the DoWCoP (Definition of Waste: Development Industry Code of Practice The purpose of the DoWCoP 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 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. This is either due to the fact that the materials were never discarded in the first place or because they have been submitted to a recovery operation and have been completely recovered so that they have ceased to be 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 the remediation strategy while planning permission may also be required.

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

#### 2.12.1.2 Materials Management Plan

An MMP shall be prepared in accordance with CL:AIRE DoWCoP and authorised by a Qualified Person registered with CL:AIRE. Excavated materials will be segregated and sorted into the following categories:

- Materials suitable for re-use on site (without needing additional treatment);

- 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 concrete, brick and other suitable building materials will be crushed to a 6F2 specification (or similar) as set out in the Series 600Highways Specification to allow for reuse on-site. Materials destined for re-use must meet the criteria proposed within the Remediation Strategy and / or MMP.

#### 2.12.1.3 Waste Recovery Permit (WRP)

The site is understood to have been leased from Tata Steel to Harsco who undertook “recycling materials from iron and steelmaking for recovery of metals” under permit PP3338MT. If the materials on the site are determined to be a waste material, they will be required to be recovered in accordance with a bespoke Waste Recovery Permit (WRP) as a ‘deposit for recovery’ operation.

The Permit would require the excavated materials to be segregated and sorted into the following categories – mirroring the requirements of an MMP:

- Materials suitable for re-use on site (without needing additional treatment);
- 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 concrete, brick and other suitable building materials will be crushed to 6F2 as specified by the Highways Specification to allow for reuse on-site. Materials destined for re-use must meet the criteria proposed within the Remediation Strategy.

Materials destined for re-use must meet the criteria proposed within the Remediation Strategy and the requirements set out in the DfR permit to ensure that the obligation are met and the materials are not classified as a waste. It should be noted that, should a DfR permit application be required this is a significantly more onerous and expensive process than using the CL:AIRE DoWCoP.

As such Arcadis recommend that initial discussions with the EA are held to establish the applicability of the DoWCoP for use at the site for all the material to be excavate and re-used.

# 3 Shallow Soil Remediation and Excavation Objectives

The aim of the shallow soil remediation works at the site is to address the identified development constraints pertaining to environmental ground conditions within the shallow soils 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 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 identified pollutant linkage between asbestos in shallow Made Ground such that that exposure pathway for on-site commercial workers are inactive.
- Maximise the reuse of excavated soils by making them suitable for use under DoWCoP or WRP.
- To develop an unexpected contamination strategy in order to mitigate the risks presented in the preparation 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 ROA. The enabling earthworks objectives are to:

- Remove subsurface obstructions within the Made Ground to a depth of +6.3m OD. 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 for a generic commercial / industrial redevelopment at +8.8m OD;
- Manage perched and confined groundwater within the Made Ground encountered during excavations;
- Management of risk to external hardstanding, structures, land parcels 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 are not considered further within the ROA:

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

The excavation objectives are considered as part of this ROA, but the specific options associated with the required process are not formally assessed.

It is not the intention of this ROA to address geotechnical development constraints at the site as these are the responsibility of the developer and dependent on a specific redevelopment scenario.

# 4 Shallow Soil Remediation Technology Selection

## 4.1 Pre-screening of Remediation Technologies

The overall aim of the remediation and parallel enabling earthworks strategy is to prepare the site for a generic development, a key part of the enabling works will involve the turning over of Made Ground deposits and the removal of relic foundations and structures across the Site. Remediation technologies that are deployed in-situ have therefore been excluded from the Remediation Options Appraisal due to the incompatibility with the required reclamation works.

As detailed plans have not been submitted for the specific development at the Site, the requirements for managing potentially aggressive ground conditions and management / protection for ground gas are currently unknown. The selection of remediation technologies therefore excludes consideration of these conditions and they will therefore be required to be managed at site redevelopment phase.

## 4.2 Selection Procedure

The selection procedure for the remediation options appraisal broadly follows the decision making process outlined by Land Contamination: Risk Management 2019 (LCRM 2019) and the Construction Industry Research and Information Association (CIRIA), incorporating guidance raised by the EA for the selection of remediation strategies. Site specific remediation objectives are broken down into the following areas:

- Technical Feasibility;
- Operational Parameters; and
- Commercial Parameters.

The objectives and site-specific constraints are prioritised in order to reconcile potential conflicts, and a ranking procedure is used to identify and evaluate potential remediation options. The remediation design selection procedure involves the following stages:

**Stage 1:** Review of the available technologies and a preliminary assessment of their suitability, based on technical feasibility;

**Stage 2:** Identification/assessment of appropriate technologies based on operational practicability; and,

**Stage 3:** Evaluation of appropriate technologies based on commercial feasibility.

Following the identification and evaluation of the appropriate technologies, professional judgement is applied to the final design of remediation strategies. This involves incorporating the design decisions along with principles such as practicability, effectiveness, durability and efficiency in order to determine the most appropriate strategy for addressing the pollutant linkages identified.

## 4.3 Stage 1 - Technical Feasibility

The first stage of the selection process is review and consideration of a wide range of remediation techniques, and use of a ranking system to select those techniques that are most feasible given the following factors:

- **Contaminant Properties**;
- **Extent of Contamination** e.g. Magnitude of contaminant concentrations, presence of NAPL, lateral extent and depth of contamination etc.; and,
- **Geology/Hydrogeology** e.g. Aquifer hydraulic conductivity, groundwater flow velocity, permeability, porosity, subsurface geochemistry.

Each remediation technique is ranked with a score of 0 to 3 based on its technical feasibility given consideration of the above factors. Also, above factors are weighted at level 3 (maximum weighting) in order that those technologies which are the most technically suited and likely to achieve the required contaminant treatment at the Site are promoted. The multiplication of rank and weight gives the relevant score for each technology. The results are combined to provide a single Technical Score and, therefore an overall Technical Ranking. The scoring rationale is as follows:

- Technology not suitable (0%);

- Technology may work (50%);
- Technology will probably work (70%); and
- Technology very suitable (>90%).

Table 1 provide an evaluation of the technical suitability of the potential remediation strategies. Where a remediation technology has been identified as being technically unsuitable, it has been eliminated further from the options appraisal and not been considered in terms of commercial and operational suitability.

## 4.4 Stage 2 and 3 – Operational & Commercial Factors

The second and third stages of the selection process builds consideration of additional key factors (operational and commercial) into the options appraisal process, using a ranking system which includes the following factors:

**Operational Factors**

- Operational Implementation;
- Long Term Operational Demands;
- Operational Requirements;
- Permissions / Permits;
- Health & Safety / Nuisance; and,
- Track Record / Development Status.

**Commercial Factors**

- Residual Liability;
- Commercial Availability;
- Implementation Timescale;
- Remediation Timescale;
- Capital Cost;
- Sustainability; and,
- Operation and Maintenance Cost.

Project specific operational and commercial factors were also incorporated to enable technologies that are most suited to implementation within the identified project constraints i.e. desire to enable future site development in a short time frame without disruption to future site use following redevelopment, to be better identified.

Each remediation technique is ranked from 1 to 3 given its likely suitability. Also, above factors are weighted from 1 to 3. The multiplication of rank and weight gives the relevant score for each technology. Table 1 provide an evaluation of the operational and commercial suitability of the potential remediation strategies.

### 4.4.1 Stage 2 - Operational Factors

#### 4.4.1.1 Operational Implementation

The Site is currently inactive with only limited site buildings remaining (to be demolished as part of the enabling works), therefore it is anticipated that the majority of remediation techniques could be implemented while the Site is in its current state with minimal disruption.

#### 4.4.1.2 Long Term Operational Demands & Implementation Timescales

Arcadis have prioritised remediation technologies which are able to be implemented within a short time frame prior to redevelopment, without significant long-term operation demands.

#### 4.4.1.3 Operational Requirements

The operational requirements for each remediation technology have been assessed and scored based on how demanding the technology is with regard to technical plant, resource requirements, electrical power and other utilities required.

#### 4.4.1.4 Permission/Permits

Each remediation technology has been considered with respect to likely requirements for operational permission/permits, for example environmental permits or abstraction consents and the difficulty of obtaining such permits for each technology. Technologies which are likely to require a lengthy permitting, licensing or consenting process have a lower score.

#### 4.4.1.5 Track Record/Development Status

The rate of success for application of each remediation technique, primarily based on experience from across the UK, is provided with an appropriate score.

### 4.4.2 Stage 3 - Commercial Factors

#### 4.4.2.1 Residual Environmental Liability

Residual environmental liability is a key consideration in the development of the remediation strategy. Technologies that break pathways, leaving contamination in place (e.g. barrier systems), as opposed to reducing contaminant mass within the source typically have a lower score.

#### 4.4.2.2 Commercial Availability

The need for specialist equipment, and whether the equipment is readily available in the UK, is considered when assigning a score to each remediation technique.

#### 4.4.2.3 Remediation Timescale and Capital Costs

Remediation technologies have been assessed giving a high priority to the overall timescale of remediation technologies (i.e. time to achieve remediation objectives following implementation) as well as overall costs given the understood need to minimise any future disturbance to post-redevelopment Site operations and to maximise the return on divestment.

#### 4.4.2.4 Operation and Management Costs

The likely operation and management costs associated with each technique are considered when assigning a score.

## 4.5 Summary

Based on the results of the ranking process, each technology has been given a final technical, operational and commercial score and, therefore, a ranking. The output of the ranking process for shallow soil impacts has been used to develop the likely remediation strategies for the shallow soils at the Site, as discussed in the next section.

The top selected technologies for the shallow soils which present a risk to Human Health are presented below and discussed in Section 5.1.

1. Capping in situ
2. Excavation and Disposal

# 5 Discussion of Selected Shallow Soil Remediation Technologies

This section presents a brief review of the selected remediation technologies which were highlighted as the most likely to be technically, operationally and commercially feasible to meet the remediation objectives at the site.

## 5.1 Technologies for Materials Unsuitable for Reuse

### 5.1.1 Capping in situ

Capping in situ is a process whereby a barrier is placed between the contaminated material and the receptor in order to break the exposure pathway. A temporary capping system may be installed to enable development plans to be finalised prior to the installation of permanent capping in areas not covered in hardstanding. The permanent cap design would be dependent on the redevelopment scenario but would likely include a geotextile liner overlain by clean imported material. Encapsulating material below new permanent infrastructure (such as additional buildings, roads or car parks) constructed as part of any redevelopment would also be considered an appropriate capping method.

**Advantages:**

- Capping will address asbestos identified in the shallow unsaturated soils;
- Minimises exposure to construction workers during remediation activities as material is left in situ; and,
- Sustainable remediation approach.

**Disadvantages:**

- Contaminated material remains on site and therefore liability is retained;
- The lifespan of the cap will likely be significant but may need replacement in the future;
- Future ground works will need to be planned to avoid breaching the cap; and
- A cap would be installed based on a specific redevelopment scenario, additional remediation works may be required if additional redevelopment occurs in the future.

### 5.1.2 Excavation and Disposal

Excavation and disposal involves the removal of contaminant material from site and disposal at an appropriately licensed waste management/treatment facility. Imported material is used to backfill the excavation. Excavation and disposal is not considered appropriate for a main remediation technology approach due to the inherent low sustainability of the technology, it is however recognised that isolated materials considered difficult to treat or not suitable for the main selected remediation technology may require disposal off site to meet remediation criteria or development timescales.

**Advantages:**

- Soil excavation will address all the asbestos identified in the shallow unsaturated soils;
- Contaminant hot spots identified as part of redevelopment can be excavated rapidly; and
- Would allow simultaneous removal of obstructions within the Made Ground;

**Disadvantages:**

- Excavation and off-site disposal of impacted soils to landfill will involve significant vehicle and traffic movements on and off-site, and likely affect neighbouring residents;
- Below ground utilities on-site may be affected and require replacement;
- Groundwater / perched water management and treatment may be required where excavation of saturated Made Ground is required;
- Although there may be scope to re-use excavated material elsewhere on the STDC site plant, haulage, and disposal costs would still be significant;
- Excavation activities can lead to excessive noise, dust and odour generation without proper controls; and,

- Would require a corresponding volume of material to be imported to site to maintain site levels requiring further lorry movements with associated issues.
- Large scale excavation and disposal (landfilling) is not considered to be a sustainable or cost effective remediation approach.

# 6 ROA Conclusions

## 6.1 Environmental Remediation

The overall aim of the remediation of shallow soils and parallel enabling earthworks strategy is to prepare the site for a generic development, a key part of the enabling works will involve the turning over of Made Ground deposits, a cut and fill process and the removal of relic foundations and structures across the Site.

Arcadis have conducted a ROA to:

- Provide a robust environmental constraints management strategy for the shallow soils at the Metals Recovery Processing Area site, considering residual liabilities, reputational issues and statutory requirements, which evaluates the risks from the identified contamination and ground conditions at the site; and
- Evolve potential remediation strategies, minimising the environmental legacy of STDC relating to the shallow soils and positioning the site footprint for redevelopment as a generic commercial / industrial end use, in a manner that will comply with applicable HSE and waste regulations while minimising life-cycle costs to STDC.

As part of the ROA, Arcadis have summarised the current contaminant distribution, site conditions, hydrogeology, and active pollutant linkages for the shallow soils based on the available data collected to date.

Based on a review of the results of the ranking process, site specific knowledge, consideration of the key remediation objectives, and view that the risk to human health receptors is the key driver for remediation at the site, Arcadis identified **capping *in situ*** as a preferred remediation strategy for the Human Health exceedances and asbestos identified at the site

## 6.2 Potentially Expansive Slags

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. It is not the intension of this ROA to address the potential risks posed by these materials. The management through the use of engineering controls are likely to be required depending on the final redevelopment and these are to be the responsibility of the developer.

## 6.3 Flood Risk

The Wood “Flood Risk Assessment and Drainage Strategy Flood Risk Assessment and Drainage Strategy” (Ref. 41825-WOOD-XX-XX-RP-OW-0001_A_P01) concluded that the potential import of up to 500mm mudstone onto the site did not increase the surface water flood risk.

The planning application R/2020/0465/FFM “*Demolition of existing buildings/ structures and engineering operations associated with ground remediation and preparation of land for development*” is assumed to comprise the excavation and crushing of hardstanding and other impermeable obstructions within the Made Ground and their backfill within the excavation. As such, Arcadis considers that following removal of hardstanding this approach will not decrease surface water infiltration rates and therefore the risk or surface water flooding both on and off-site will likely be no higher than that identified by Wood. The proposed works are also unlikely to significantly alter the surface run off and infiltration from the site into the adjoining surface water features.

# 7 Enabling Earthworks and Shallow Soil Remediation Strategy

The strategy for the enabling earthworks and shallow soil remediation of the Metal Recovery Processing Area site should be considered within the wider context of the Redcar Steelworks reclamation and remediation strategy. The excavated materials identified as not suitable for direct reuse will be consigned to a remedial process in order to meet the criteria for reuse after treatment.

## 7.1 Aim

The aim of the works is to:

- Remove underground relic structures and foundations;
- Process Made Ground in order to make suitable for use as backfill materials, and
- Make the site suitable for future commercial / industrial end-use through SPR linkage breaks from materials impacted with asbestos.

## 7.2 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 maximum depth of +6.3m OD. 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 and potentially expansive slag deposits in order to make suitable for reuse.
- Segregation of soils with ACM for appropriate reuse within the remediation scheme;
- 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.

## 7.3 Works Approach

### 7.3.1 Enabling works

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

- Approved Schedule;
- Construction Phase Health and Safety File;
- Method Statements and Risk Assessments;
- Occupational Health Plan;
- Environmental Permit;
- Temporary Trade Effluent Discharge Consent; and
- 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.

### 7.3.2 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.

#### 7.3.2.1 Achieving Non-Waste Status

As discussed in Section 2.12, there are several different waste regulatory options available, the suitability of which is dependent upon the complexity of the site, previous permitted activities and the quantity/composition of the material to be reused. It has been concluded the two potential options are

1. Via an application in accordance with CL:AIRE guidance 'Definition of Waste: Development Industry Code of Practice' (DoWCoP).
2. Via Waste Recovery Permit (WRP) under the Environmental Permitting (England and Wales) Regulations 2016 SI2016/11542 ("the EPR")

The route to achieving non waste status must be selected in consultation with Environment Agency and status of the materials under the Environmental Permitting Regulation. An overview to the two options are included below.

#### 7.3.2.2 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 the DoWCoP 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 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. This is either due to the fact that the materials were never discarded in the first place or because they have been submitted to a recovery operation and have been completely recovered so that they have ceased to be waste.

In addition to the risk assessment, an MMP will be required detailing where soils where excavated from, where they 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 the remediation strategy. Planning permission may also be required.

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

#### 7.3.2.3 Materials Management Plan

If the DoWCoP is considered as the most appropriate route, an MMP shall be prepared in accordance with CL:AIRE Code of Practice (Definition of Waste) and authorised by a Qualified Person registered with CL:AIRE. Excavated materials will be segregated and sorted into categories as defined in Section **Error! Reference source not found.**

#### 7.3.2.4 Waste Recovery Permit (WRP)

The site is understood to have been leased from Tata Steel to Harsco who undertook "recycling materials from iron and steelmaking for recovery of metals" under permit PP3338MT. If the materials on the site are determined to be a waste material, they will be required to be recovered in accordance

with a bespoke Waste Recovery Permit (WRP) as a 'deposit for recovery' operation. If the WRP route is considered the most appropriate route, excavated materials will be segregated and sorted into categories as defined in Section 2.12.1.3

### 7.3.3 Soil Sampling

Soil sampling will be undertaken by an STDC appointed representative and at the frequency proposed Sections 7.3.6 and 7.3.7.

Representative samples will be taken from in-situ placement locations or from stockpiles. Where stockpile samples are required, they will be collected as a composite sample. Stockpiles will be subdivided to representative sections, each section will be sub-divided to 6 sub-sections, soils shall be collected from each subsection and homogenised in order to create the representative sample.

Further information on the proposed sampling strategy, including sampling frequency and testing schedule will be provided within the Earthworks Strategy and the Materials Management Plan / Waste Recovery Permit.

### 7.3.4 Excavations

#### 7.3.4.1 General Excavations

The scope of the excavation works is outlined in Section 2.11. 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 in accordance with 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, materials which are considered oversize shall be segregated and removed from the Metals Recovery Processing Area site and crushing to enable reuse. Any deleterious materials not suitable for incorporation into the fill material, such as rebar, 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.

#### 7.3.4.2 Segregation and Stockpiling

Excavated materials identified by laboratory analysis as chemically unsuitable for direct reuse will be stockpiled for treatment. Stockpile and treatment areas 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.

#### 7.3.4.3 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.

#### 7.3.4.4 Relic Underground Structures and Services

The following shall be implemented with respect to relic structures:

- Relic structures shall be removed where encountered +6.3m OD or above. Where relic structures are encountered in the level above +6.3m OD but continue below +6.3m OD confirmation on the requirement to remove them below this depth shall be required from STDC. If removal is not required a record of the residual foundation shall be made recording the topographical coordinates, size and type.
- Where encountered, piled foundations shall be removed to a maximum extent of +6.3m OD. A record of the residual foundation shall be made recording the topographical coordinates, size and type.
- Redundant pipework may potentially be encountered within the excavations which may present preferential pathways for the migration of contamination. Where encountered redundant pipe work will be removed from the excavations and sealed at the edges of excavations.

No specific 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.

#### 7.3.4.5 Boreholes

There are borehole installations planned on the Metal Recovery Area 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.

#### 7.3.4.6 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. 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 Contractors Earthworks Implementation Plan.

#### 7.3.4.7 Utilities and Services

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 would need to be reviewed and accounted for within the Contractors Earthworks Implementation Plan.

### 7.3.5 Groundwater Management

Groundwater and accumulated water may 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 requiredg to be pumped, through backfilling excavations as soon as practicable and avoiding the potential for accumulation of rainwater in open excavations. Recovered groundwater will be sampled and classified to allow appropriate disposal, either via direct disposal to site foul drainage under discharge consent, *via* on site treatment and discharge to 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.

### 7.3.6 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 SSAC for Cyanide presented in 10035117-AUK-XX-XX-RP-ZZ-0088-01-Prairie_Risk Assessment,
- 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 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 this site.

Remediation Criteria for deep soils and water resources will be defined following the completion of the deep soil and groundwater Environmental Site Assessment.

| Remediation Criteria Point | Remediation Objective | Compliance Criteria [1] |
|---|---|---|
| Excavation Extents | Ensure that concentrations of asbestos within soils within the uppermost 0.1m 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<br>• 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<br>• One sample per 50 linear metres of excavation perimeter; and,<br>• One sample per cell on a grid of 100m of excavation base |
| Imported Materials | 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 1,000 $m^3$ of imported material (with a minimum of three samples per source) do not exceed the Remediation Criteria. |

[1] Sampling frequency to be formalised and agreed as part of Remediation and Reclamation Implementation Plan and MMP

### 7.3.7 Suitability for Use Criteria

For excavated materials the following reuse criteria will apply:

| Reuse Criteria Point | Objective | Compliance Criteria [2] |
|---|---|---|
| Reuse | To ensure that concentrations of contaminants within materials proposed for reuse do not exceed agreed reuse criteria. | Composite soil samples collected at a frequency of one sample per 2,000m$^3$ of material proposed for re-use.<br>Human Health - Laboratory analysis confirms concentrations of contaminants are below the criteria set out in Wood 2019 (LQM S4UL and Wood GAC).<br>Water Resources – Reuse criteria to be confirmed by the DQRA<br>Geotechnical – Backfill inline with Highways Specification. Exact specification to be confirmed in Earthworks Specification |

#### 7.3.7.1 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.

In order to facilitate development a temporary cover system should be installed across the footprint of the site, this temporary cover system should comprise a minimum of 100mm of certified imported materials. The presence of the cover system should be considered when the final construction phase planning and design are finalised.

As part of the future developer led re-development works, where hardstanding is not present and providing the required cover system, such as areas of soft standing, 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.

#### 7.3.7.2 Management of Asbestos Containing Materials (ACM)

Asbestos fibres have been identified at a number of locations across the site in made ground during the investigative works. No ACM hotspots have been identified, with fibre concentrations generally in the range of <0.002% to 0.003%. During excavation works to remove underground structures there is the potential for ACM to be encountered. In the event that suspected 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.

[2] Sampling frequency to be formalised and agreed as part of Earthworks Strategy and MMP

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 CoC 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. Where concentrations are below the reuse threshold soils may be reused as infill to excavation voids at depths below the temporary cap or 0.6 m of final ground level in areas not covered with hardstanding in the final development.

### 7.3.8 Unexpected Contamination

Changes to the remediation strategy may be required during the remediation works, as a result of encountering unexpected contamination[3]. Should unexpected contamination be encountered, then further characterisation and risk assessment will be undertaken as required. 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.

### 7.3.9 Anticipated Enabling Earthworks and Remediation Extents and Quantities

The anticipated extent of the enabling earthworks and remediation are graphically represented on Drawing Numbers JSH009 – JSH011 produced by Halls Construction Services Limited included within Appendix A.

### 7.3.10 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 7.3.6.

### 7.3.11 Backfill

All Made Ground will be excavated and screened to remove oversize or deleterious material. Deleterious material will be removed from site as a waste. 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.

Groundworks models with cut and fill levels have been provided by Halls Construction Services Limited and are graphically represented on Drawing Numbers JSH009 – JSH011 included within Appendix A

At the time of writing the Earthworks Specification is in press. Following the completion of the Earthworks Specification, the excavation, processing and backfilling specifications of this document will be required to be updated to reflect any changes.

Where required imported materials shall be used to fulfil any materials deficit. It is proposed that the imported materials shall form the required capping materials. Imported material must be certified free of asbestos and other deleterious material. 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, it is anticipated that the imported materials will provide the required cover system to meet the remediation objectives. Site won materials that are re-used on site must be demonstrated as suitable for use in accordance with the MMP/WRP. Prior to backfill, excavations will be dewatered. Excavations will be backfilled in layers in accordance with the Highway Specifications.

### 7.3.12 Environmental Controls and Management

A Construction Phase Environmental Management Plan (CPEMP) should be prepared for the Works and shall consider the following environmental aspects.

[3] 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.

### 7.3.12.1 Surface Water Management

A surface water management plan shall be developed and implemented as a component of the CPEMP 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.

Surface water and other water generated as part of the Works shall be monitored and treated via a drainage silt trap / settlement tank, or similar, to remove solids and fines from the water. Any further treatment necessary to effect compliance with the consent limits shall be designed, installed and maintained.

### 7.3.12.2 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 CPEMP. 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 transfer of mud and debris from the site onto public roads.

Noise

Prior to commencement on site noise data will be taken to establish baseline conditions. Trigger levels to prevent unacceptable impacts to receptors shall be identified within the CPEMP 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 on site vibration levels will be taken to establish baseline conditions. Trigger levels to prevent unacceptable impacts to receptors shall be identified within the CPEMP 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.

### 7.3.12.3 Ecology/Invasive Species

There are a number of designated ecological sites in close proximity to the Metals Recovery Processing Site namely the Teesmouth and Cleveland Coast SPA (250m) and The Teesmouth and Cleveland Coast Ramsar (1.3km north-west).

As there are breeding shelduck in the Lackenby Channel, it has been recommended that:

a) either construction is avoided within 300m of the Lackenby Channel during the breeding bird season (March to August inclusive); and if this is not possible

b) that visual disturbance screening is installed to minimise disturbance to the Lackenby Channel. This screening should be installed and in place prior to the breeding bird season.

In order to protect breeding birds including the Shelduck, removal of any vegetation on the site should be undertaken outside of the breeding bird season (March to August inclusive). If this is not possible, a nesting bird check by a Suitably Qualified Ecologist (SQE) immediately prior to vegetation removal is required.

To mitigate against significant adverse effects to wintering birds within the SLEMS and the River Tees (through the Lackenby Channel) measures shall be deployed to prevent sediment, dust, surface water run-off, or any other substance relating to construction from impacting wintering birds

No invasive species have been recorded within the Metals Recovery Processing Area site, however, there is the potential for invasive species to be present or to colonise the area. If invasive species are

noted, control or removal of these species must be undertaken in line with guidance provided by a SQE in order to remain legally compliant.

During groundworks the Contractor shall take measures to prevent sediment, dust, surface water run-off, or any other substance relating to construction from entering the SLEMS, Lackenby Channel or other surface water features.

The control measures and mitigation identified shall be reviewed by a SQE and shall be adopted in relations to the remediation and restoration works and future development.

# 8 Reporting

## 8.1 Pre-commencement

### 8.1.1 Enabling Earthworks Remediation Implementation Plan

The specific objective of the Enabling Earthworks and Remediation Implementation Plan (EERIP) is to produce a site-specific plan detailing the design and methodology of the selected remediation approach to be applied at the site. This will incorporate the remediation programme and the monitoring and validation requirements.

The EERIP will be undertaken in accordance with the requirements of LCRM guidance and will include the following tasks:

- Review of the site characteristics – in particular any variation from currently known conditions;
- Development of remediation technical specification for placement of the capping material;
- Development of implementation methodology;
- Discussion of any additional regulatory requirement; and,
- Details on methodology for verification of remedial works.

### 8.1.2 Materials Tracking

If determined as the most appropriate route an MMP shall be prepared by the appointed Contractor in accordance with CL:AIRE DoWCoP and authorised by a Qualified Person registered with CL:AIRE.

If it is determined that a Waste Recovery Permit is the most appropriate route then materials movements will be tracked and audited in accordance with the agreed permit requirements. .

### 8.1.3 Construction Phase Environmental Management Plan

The appointed Contractor will prepare a construction phase environmental management plan (EMP)_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 EMP will include methodologies for controlling and monitoring the following aspects of the works:

- Waste Management Procedures,
- Noise and vibration management,
- Air quality and dust management,
- measures to prevent sediment, dust, surface water run-off, or any other substance relating to construction from entering the Slems (wetland area south of the site) and the Lackenby Channel,
- Any ecological mitigations required,
- Surface water drainage,
- Spills and environmental releases,
- Monitoring and measuring procedures, and

Relevant policies, legal requirements and key stakeholders.

The EMP shall be reviewed by an SQE prior to the implementation of the works

## 8.2 Implementation

During remediation implementation, regular progress meetings will be held and documented with meeting minuted by the remediation contractor. 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 8.3 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.

## 8.3 Remediation Works Verification Report

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

### 8.3.1 Field records

Field records to verify the works may include the following

- Excavation extents and depths supported by topographic survey data;
- Field screening / onsite analysis of soil samples; and,
- Photographic records.

### 8.3.2 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. Results should be provided in AGS4 and ESDAT format to allow incorporation into electronic databases for the wider site.

### 8.3.3 Topographic Survey Records and Drawings

Site drawings and topographic plans will be developed 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

### 8.3.4 Materials Audit Trail Records & Environmental Monitoring

The results of the monitoring and testing set out in the EMP, 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 or Waste Recovery Permit;
- 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


## Legend

Site Boundary

Metals Processing Area

Notes:



CONTACT ARCADIS IN CASE OF ANY QUERIES.

N

**Title: MPA - Site Location Plan**

**Site:**
**Redcar Steelworks - MPA**

**Client:**
**South Tees Developement Corporation**

| **Project:** 10035117 | **Figure 1** |
|---|---|

**Date: 07/08/2020**
**Drawn By: JALM**
**DRG No: 10035117-AUK-XX-XX-DR-ZZ-0127-01-MPA_SLP**

ARCADIS Design & Consultancy for natural and built assets



## Legend

Redline

Metals Recovery Area

Hatching Shows Artificial Ground

Notes:



CONTACT ARCADIS IN CASE OF ANY QUERIES.

**Title: MPA - Anticipated Geology**

**Site:**
**Redcar Steelworks - MPA**

**Client:**
**South Tees Developement Corporation**

**Project:**
**10035117**

**Figure 2**

**Date: 01/04/2020**
**Drawn By: JALM**
**DRG No: 10035117-AUK-XX-XX-DR-ZZ-0126-01-MPA_Geology**

ARCADIS Design & Consultancy for natural and built assets


## Legend

### Maps

Bing Mapping

Asbestos Detected

- Sample ID and Quantification %

Redline

- Metals Recovery Area

Notes:



CONTACT ARCADIS IN CASE OF ANY QUERIES.

N

**Title: MPA - Asbestos Detection and Quantification Data**

**Site:**
**Redcar Steelworks - MPA**

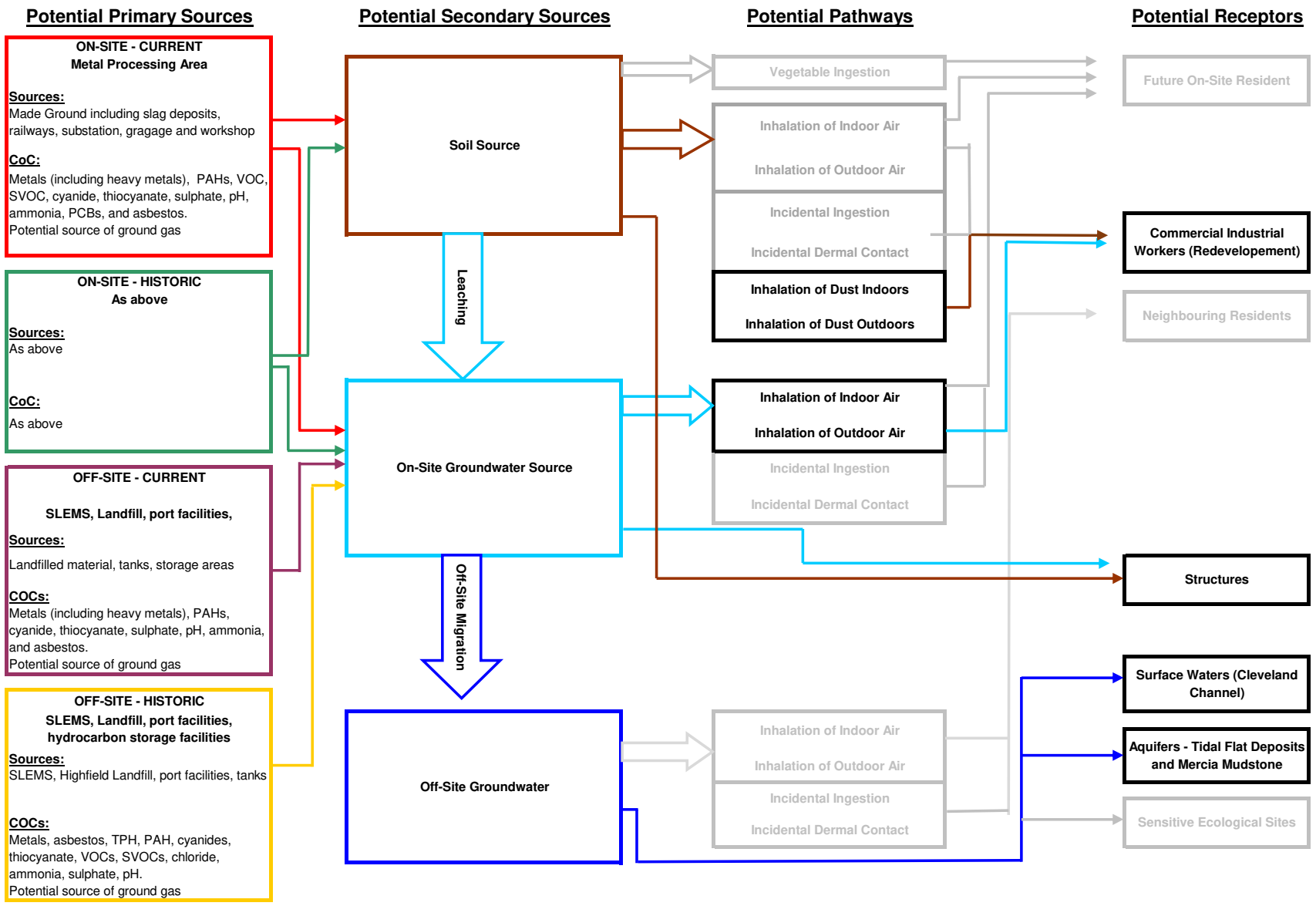
**Client:**
**South Tees Developement Corporation**

| **Project:** 37774100 | **Figure 3** |
|---|---|

**Date: 01/09/2020**
**Drawn By: JALM**
**DRG No: 10035117-AUK-XX-XX-DR-ZZ-0185-01-MPA_Asb**

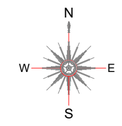
ARCADIS Design & Consultancy for natural and built assets

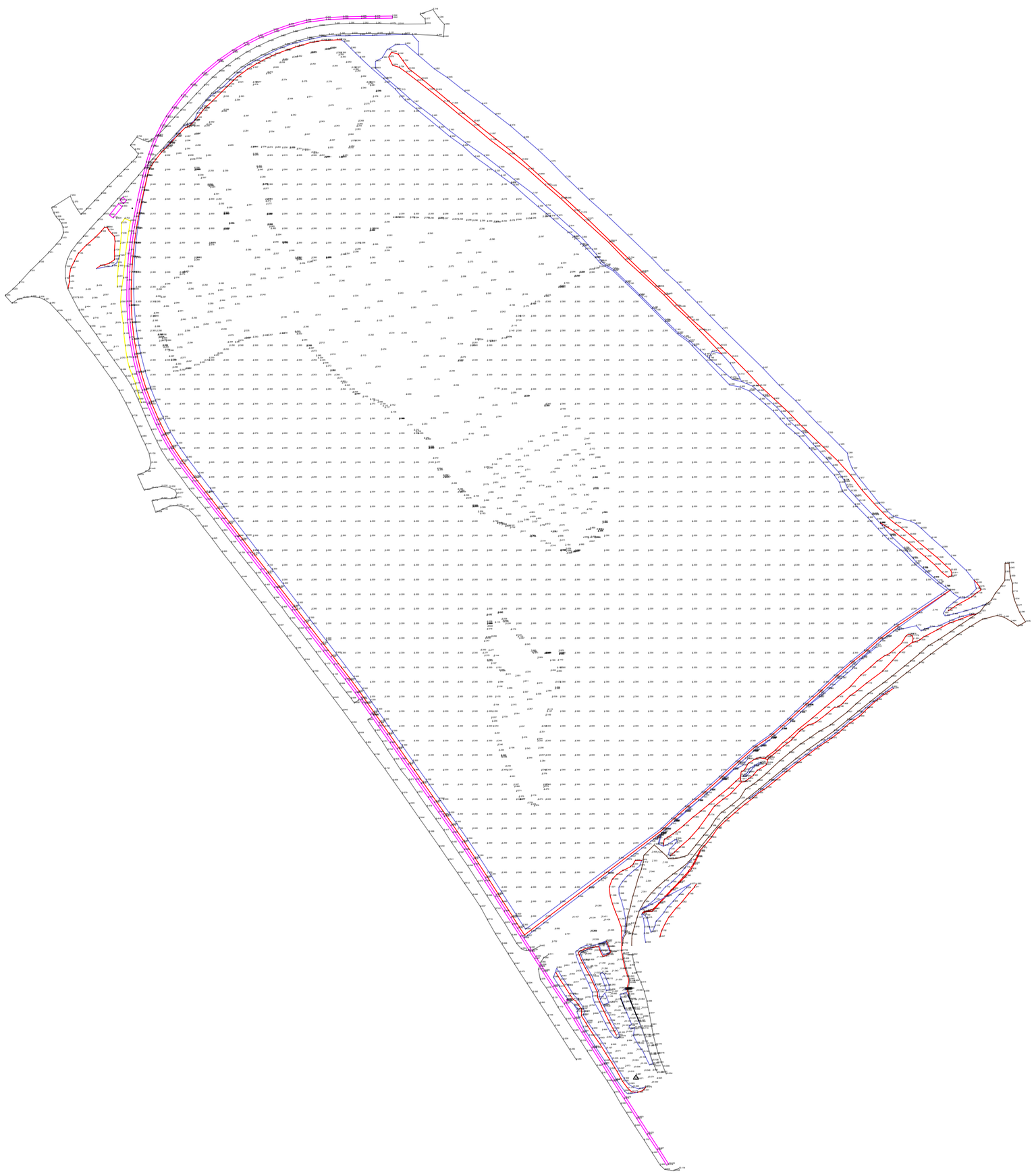
# Outline Conceptual Site Model - Commercial Industrial End Use




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

ARCADIS Design & Consultancy for natural and built assets



**Hallconstruction**
www.hallconstruction.uk.com

Metals Recovery
Redcar
JOB TITLE

STDC
CLIENT

Design Full Site
Formation
30-09-20
DRAWING TITLE

| 1:2000 @ A1 | JSH |
|---|---|
| SCALE | DRAWN |
| 02-10-20 | AJB |
| DATE | APPROVED |

**Hall Construction Services Limited**
Stotforth Hill House
Windlestone
Rushyford
County Durham
DL17 0NF
Tel: 01325 311013
Fax:01325 311571

NOTES

| REV | AMENDMENT | DRAWN | CHECKED |
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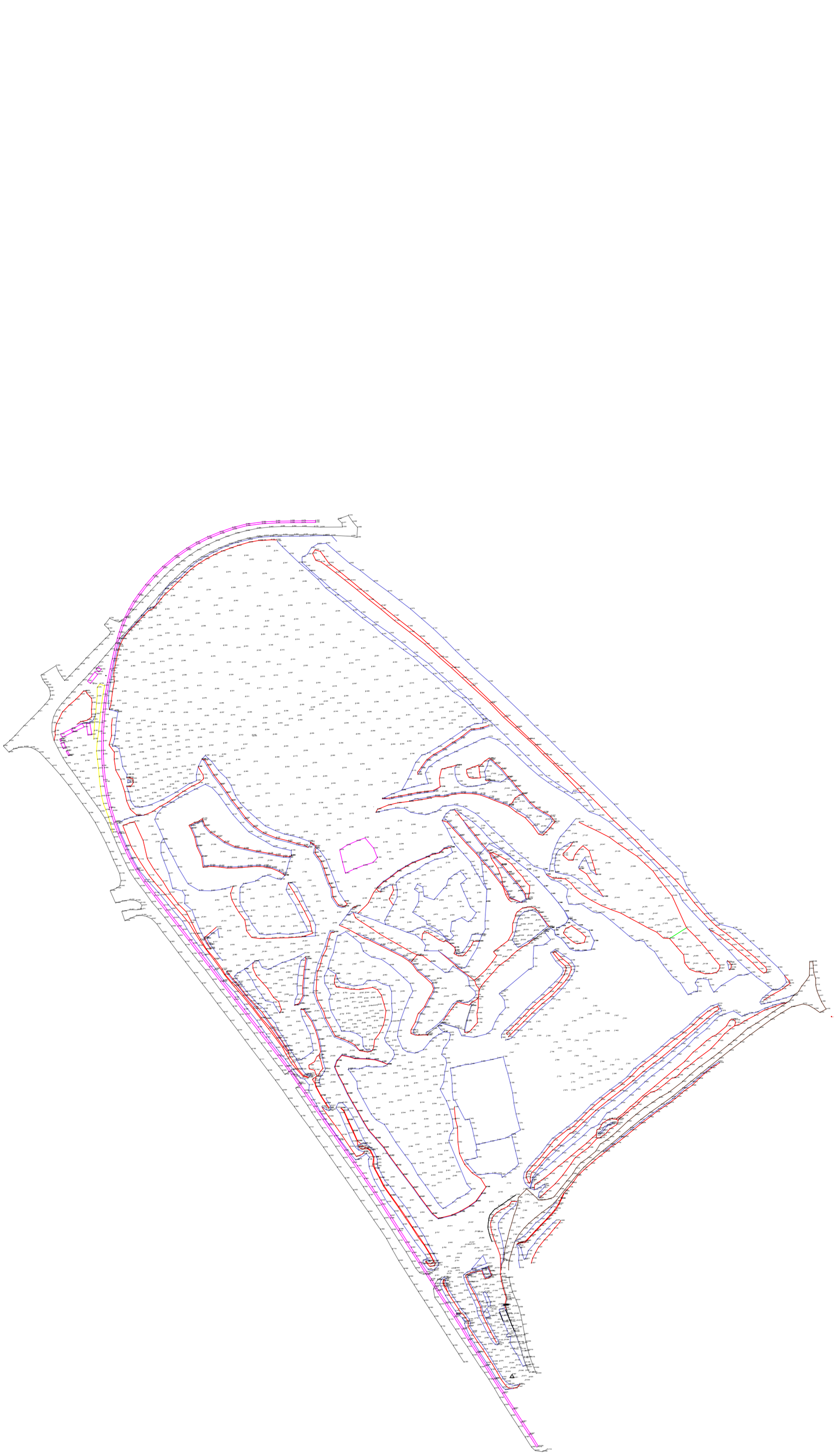
| 2366 | JSH009 | A |
|---|---|---|
| PROJECT No. | DRAWING No. | REV |




**Hall**construction
www.hallconstruction.uk.com

Metals Recovery
Redcar

JOB TITLE

STDC

CLIENT

Full Site Composite
Survey
30-09-20

DRAWING TITLE

| 1:2000 @ A1 | JSH |
|---|---|
| SCALE | DRAWN |
| 02-10-20 | AJB |
| DATE | APPROVED |

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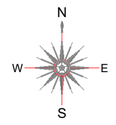
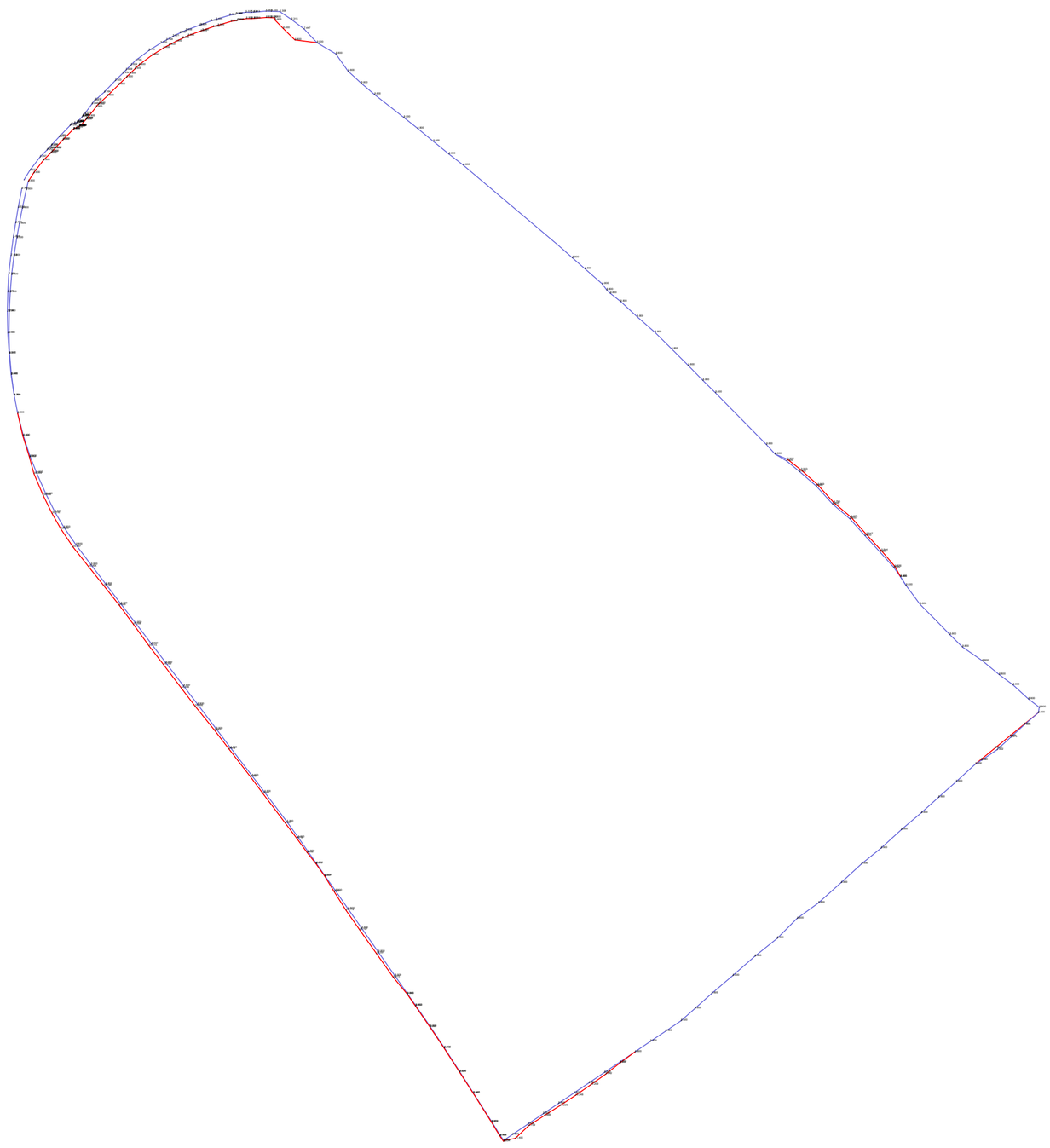
NOTES

| REV | AMENDMENT | DRAWN | CHECKED |
|---|---|---|---|

| 2366 | JSH010 | A |
|---|---|---|
| PROJECT No. | DRAWING No. | REV |



**Hallconstruction**
www.hallconstruction.uk.com

Metals Recovery
Redcar
JOB TITLE

STDC
CLIENT

Design Full Site
Finished Levels
02-10-20
DRAWING TITLE

| 1:2000 @ A1 | JSH |
|---|---|
| SCALE | DRAWN |
| 02-10-20 | AJB |
| DATE | APPROVED |

**Hall Construction Services Limited**
Stotforth Hill House
Windlestone
Rushyford
County Durham
DL17 0NF
Tel: 01325 311013
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NOTES

| REV | AMENDMENT | DRAWN | CHECKED |
|---|---|---|---|

| 2366 | JSH011 | A |
|---|---|---|
| PROJECT No. | DRAWING No. | REV |

# 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

## Remediation Option Appraisal Tables

**Table 1**
**Remediation Technology Selection**
**Contaminants of Concern (CoC) in Soil**
**Industrial End Use Scenario**

| Technology | Biological Techniques | | Chemical Techniques | | | Physical Techniques | | | | Ex Situ Techniques | | | | | | Score | Weighted Coefficient | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Source Zone Depletion (SZD)** | **Bioventing** | **Chemical Oxidation or Reduction** *via In Situ* Soil Mixing | ***In Situ* Chemical Oxidation (ISCO)** | ***In Situ* Stabilisation / Solidification** | **Soil Vapour Extraction** with potential low thermal enhancement | ***In-Situ* Thermal Desorption** via Conductive Heating | **In-Situ Thermal Treatment** (Enhanced Physical Recovery) | **Capping Layer** to break Source Pathway Receptor Linkage | **Excavation & Off Site Disposal / Treatment** | **Ex Situ Bioremediation Amended Biopiles / windrows** | **Ex Situ Physical Treatment (Soil Vapour Extraction)** | **Ex Situ Chemical Treatment (Stabilisation / Oxidation)** | **Ex Situ Soil Washing** | **Ex Situ Thermal Treatment (Thermopile or StarX)** | | | |
| **Technical Parameters** | | | | | | | | | | | | | | | | | | |
| Contaminant Properties | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | **9** Proven technology used widely to treat CoC | **9** Proven technology used widely to treat CoC | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 - Technology not suitable<br>1 - Technology may work (50%)<br>2 - Technology will probably work (70%)<br>3 - Technology very suitable (90% +) | **x 3** | 1 - Less Important<br>2 - Important<br>**3 - Very Important** |
| Extent of Contamination (concentration, distribution and plume dimensions) | | | | | | | | | **9** Technology can be applied over large treatment zones | **9** Off Site Treatment Facilities routinely accept waste types | | | | | | 0 - Technology not suitable<br>1 - Technology may work (50%)<br>2 - Technology will probably work (70%)<br>3 - Technology very suitable (90% +) | **x 3** | 1 - Less Important<br>2 - Important<br>**3 - Very Important** |
| Geology / Hydrogeology Suitable | | | | | | | | | **9** No processing of materials required | **9** No processing of materials required | | | | | | 0 - Technology not suitable<br>1 - Technology may work (50%)<br>2 - Technology will probably work (70%)<br>3 - Technology very suitable (90% +) | **x 3** | 1 - Less Important<br>2 - Important<br>**3 - Very Important** |
| | | | | | | | | | | | | | | | | | | |
| **Technical Score** | | | | | | | | | **27** | **27** | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| **Technical Ranking** | | | | | | | | | **1** | **1** | | | | | | | | |
| **Operational Parameters** | | | | | | | | | | | | | | | | Score | Weighted Coefficient | |
| Operational Implementation | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | **6** Technology requires capping layer to be installed over treatment area | **2** Increased traffic movements during excavation works including off site and reimportation of materials. | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 - Impacts on site operation not acceptable<br>1 - High impact on working operation of site<br>2 - Minor impacts on working operation of site<br>3 - Minimal impacts on working operation of site | **x 2** | **1 - Less Important**<br>2 - Important<br>3 - Very Important |
| Long Term Operational Demands | | | | | | | | | **6** May cause some restrictions on future land development to avoid damage to the capping material or require cap to be reinstated if damaged | **9** No long term requirements identified | | | | | | 0 - Impacts on site operation not acceptable<br>1 - High impact on working operation of site<br>2 - Minor impacts on working operation of site<br>3 - Minimal impacts on working operation of site | **x 3** | 1 - Less Important<br>2 - Important<br>**3 - Very Important** |
| Operational Requirements | | | | | | | | | **9** | **6** | | | | | | 1 - Substantial operational requirement (e.g. power and large plant required)<br>2 - Relatively large operational requirement (e.g. power and portable plant)<br>3 - Very minor operational requirement (e.g. monitoring only) | **x 3** | 1 - Less Important<br>2 - Important<br>**3 - Very Important** |
| Health & Safety / Nuisance | | | | | | | | | **9** Placement of imported material required | **3** Dust, noise, traffic and other nuisance would need to be managed. Significant increased traffic on wider site. | | | | | | 1 - Higher risk remediation activity / Higher potential for nuisance<br>2 - Lower risk remediation activity / lower potential for nuisance<br>3 - Minimal risk remediation activity / Minimal potential for nuisance | **x 3** | 1 - Less Important<br>**2 - Important**<br>3 - Very Important |
| Track Record / Development Status | | | | | | | | | **6** Commonly applied and proven technology | **6** Commonly applied and proven technology | | | | | | 1 - Remediation approach has had limited application at full scale<br>2 - Remediation approach been applied with successful case studies<br>3 - Remediation approach has been used extensively | **x 2** | 1 - Less Important<br>**2 - Important**<br>3 - Very Important |
| | | | | | | | | | | | | | | | | | | |
| **Operational Score** | | | | | | | | | **36** | **26** | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| **Operational Ranking** | | | | | | | | | **1** | **2** | | | | | | | | |
| **Commercial Parameters** | | | | | | | | | | | | | | | | Score | Weighted Coefficient | |
| Residual Liability | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | **3** Mass is not depleted, pathways to receptors on and off site need to be demonstrated to be controlled / broken. | **6** Removal of contaminant mass from site | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 In-situ technologies discounted during pre-screening | 0 - Technology as stand alone not suitable to achieve remediation objective<br>1 - Technology may achieve remediation objective (50% possibility)<br>2 - Technology would achieve remediation objective (70% possibility)<br>3 - Technology would achieve remediation objective (90% possibility) | **x 3** | 1 - Less Important<br>2 - Important<br>**3 - Very Important** |
| Commercial Availability | | | | | | | | | **3** Equipment required is readily available | **3** Equipment required is readily available | | | | | | 1 - Equipment not readily available<br>2 - Equipment available<br>3 - Equipment readily available | **x 1** | **1 - Less Important**<br>2 - Important<br>3 - Very Important |
| Implementation Timescale | | | | | | | | | **3** Technology could be applied reasonably quickly | **3** Technology could be applied reasonably quickly | | | | | | 1 - Slow >3 years<br>2 - Moderate 1-3 years<br>3 - Fast <1 year | **x 1** | **1 - Less Important**<br>2 - Important<br>3 - Very Important |
| Remediation Timescale | | | | | | | | | **3** Technology could be applied reasonably quickly | **3** Technology could be applied reasonably quickly | | | | | | 1 - Slow >10 years<br>2 - Moderate 5-10 years<br>3 - Fast <5 years | **x 1** | **1 - Less Important**<br>2 - Important<br>3 - Very Important |
| Capital Cost | | | | | | | | | **9** Application of cap is relatively in expensive and could be sourced from within the STDC development. | **3** Cost of disposal is high | | | | | | 1 - High<br>2 - Medium<br>3 - Low | **x 3** | 1- Less Important<br>2 - Important<br>**3- Very Important** |
| Sustainability | | | | | | | | | **6** Reuse of materials sourced from the STDC wider development | **3** Landfill unsustainable solution, high carbon footprint including haulage | | | | | | 1 - Low<br>2 - Medium<br>3 - High | **x 3** | |
| Operation & Maintenance Cost | | | | | | | | | **6** Potential requirement to replace / manage the capping layer | **3** Enabling works, excavation safety controls, some dewatering and nuisance controls required as well as large plant and backfill material during active works | | | | | | 1 - High<br>2 - Medium<br>3 - Low | **x 3** | 1 - Less Important<br>2 - Important<br>**3 - Very Important** |
| | | | | | | | | | | | | | | | | | | |
| **Commercial Score** | | | | | | | | | **33** | **24** | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| **Commercial Ranking** | | | | | | | | | **1** | **2** | | | | | | | | |
| **Overall Summary** | | | | | | | | | | | | | | | | | | |
| **Overall Score** | | | | | | | | | **96** | **77** | | | | | | | | |
| **Overall Ranking** | | | | | | | | | **1** | **2** | | | | | | | | |

Arcadis (UK) Limited

One Whitehall Riverside
Leeds LS1 4BN
United Kingdom

T: +44 (0)113 284 5333

**arcadis.com**