South Bank, Teesworks, Redcar

Detailed Quantitative Risk Assessment

South Tees Development Corporation

Document Ref: 10035117-AUK-XX-XX-RP-ZZ-0331-02-SB_DQRA

Revision: 02

SEPTEMBER 2021

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Document Ref.	10035117-AUK-XX-XX-RP-ZZ-0331-01-SB_DQRA
Date	JULY 2021

Version Control

Version	Date	Author	Checker	Reviewer	Approver	Changes
DRAFT	**July 2021**	**SH**	**SH**	**KB**	**NT**	
02	**September 2021**	**SH**	**SH**	**KB**	**NT**	

Executive Summary	
Background	Arcadis Consulting (UK) Limited (Arcadis) was commissioned by South Tees Development Corporation to undertake a Detailed Quantitative Risk Assessment (DQRA) at the South Bank Area (SB, "the site"), situated at the Teesworks, located within the industrial area generally known as 'South Tees', TS10 5QW (indicative postcode). The South Tees Regeneration Masterplan has been developed detailing the industrial-led regeneration of the Teesworks into a world class employment-generating zone and economic growth enabler for the Tees Valley.
Site Description	South Bank comprises three main areas, A, B & C (SBA, SBB and SBC), which have each been investigated as part of a site wide strategy for assessing the South Bank Area and wider South Tees development area. It also encompasses the recently investigated South Bank Coke Ovens (SBCO) area which lies predominantly within SBA. The entirety of SB is reclaimed land from the River Tees Estuary. The Made Ground used for the land reclamation is primarily composed of by-products from surrounding industrial processes, including slag. A number potentially contaminative historical land uses have occurred at SB. These include, but are not limited to, the SBCO, fuel storage (including Heavy Fuel Oil [HFO] tanks), metal and galvanizing works, phosphate works, basic slag works and rail sidings and stocking.
Previous Environmental Works	Environmental Site Assessment (ESA) reports for the three main areas of SBA, SBB and SBC have been completed. The ESAs for SBA, SBB and SBC include a Generic Quantitative Risk Assessment (GQRA) undertaken by Arcadis. A Ground Investigation and GQRA Report was also undertaken by Royal Haskoning which covers the quayside areas of SBA and SBB. The conclusions of the GQRA undertaken were that concentrations of arsenic, lead, benzene, dibenzofuran, 1,2 dichloroethane and polycyclic aromatic hydrocarbons (PAHs) were measured exceeding the GAC in soil for the protection of human health. It was recommended that risks to human health are considered at the design stage of any proposed redevelopment with regards to dermal, ingestion and inhalation pathways. In relation to water resources, several exceedances of WQS were measured on site, primarily relating to those wells screening the Made Ground and the Tidal Flat Deposits. In addition to the recent 2020/2021 investigations, investigations were also completed in 2004 and 1999 by Enviros and AEG respectively. Given the age of these investigations, and the coverage of the recent 2021 investigations, the DQRA was primarily based upon the 2020/2021 data.
Scope and Objectives	To further assess the contaminant of concern (CoC) identified as exceeding the relevant water quality standards (WQS) in the GQRAs undertaken by Arcadis and Royal Haskoning. The DQRA focuses on water resource receptors, specifically, the River Tees is located just beyond the northern border of the site. The scope of the water resource DQRA includes: • Assessment of the potential risk posed to water resources using a source-pathway-receptor approach to refine the existing conceptual site model (CSM); and, • Evaluation of the need for remediation works to be undertaken. In relation to human health, the GQRA undertaken is considered to provide an appropriate level of assessment based on what is known of the planned redevelopment scenario. Therefore, human health assessment has not been included within the scope of the DQRA.
Site Setting	**Geology** The site is underlain by Made Ground of up to 11.6m thickness, comprising mainly slag dominated material and typically highly granular in nature. Made ground is underlain by

	superficial deposits of Tidal Flat Deposits, comprising a mix of sands and silts. Beneath the Tidal Flat deposits, the layering of superficial deposits varies across the site but includes Glaciolacustrine Deposits, Glacial Till and sands and gravels (potentially weathered bedrock). Beneath the superficial deposits is bedrock of the Mercia Mudstone. **Hydrogeology** The Tidal Flat Deposits and the Mercia Mudstone are designated as Secondary A and Secondary B aquifers respectively. The remaining units identified are classified as unproductive strata. Groundwater beneath the site was measured resting within the Made Ground, with a flow direction in the Made Ground towards the north/northeast, towards the River Tees. **Hydrology** The River Tees is present approximately 20m to the north of the site boundary. The River Tees is a tidal estuary, flowing towards the northeast. The Teesmouth and Cleveland Coast is also a designated Ramsar site, Site of Special Scientific Interest (SSSI) and a Special Protection Area (SPA).
Sources	Potential sources of contamination exist on site associated with the Made Ground and historical use of the site. Review of the contaminant distribution identified two sources to assess: • **Made Ground source** from across the site – considered to comprise a single diffuse soil source associated with Made Ground and slag. • **Groundwater source** in the vicinity of SBC_AUK_BH110 – considered to represent contamination associated with the SBCO area and also the location of identified non-aqueous phase liquid (NAPL). Diffuse groundwater contaminants found throughout the site associated with Made Ground include metals, hydrocarbons including PAH, inorganics including cyanide, ammonia and sulphate and other organic compounds such as phenolics. Groundwater contaminants associated with SBCO include metals, hydrocarbons (including tars), PAH, inorganics including cyanide, ammonia and sulphate and other volatile and semi-volatile organic compounds.
Pathways	The following pathways are considered potentially active in relation to water resource receptors: • Leaching of CoC from soil into groundwater • Migration in groundwater through the Made Ground towards the surface water receptor (River Tees Estuary) and subsequent dilution within the receptor • Vertical migration of impacts down relic foundation piles is also considered potentially active.
Receptors	The primary water resource receptor associated with the site was considered to be The River Tees. The Teesmouth and Cleveland Estuary itself is designated Ramsar site, SPA and a SSSI. Groundwater was not assessed as a receptor at significant risk based the industrial history of the site and its surroundings, the brackish nature of the groundwater due to proximity to the estuary and the low potential for groundwater abstraction for potable water in the future. The resource potential for the underlying aquifers is therefore considered to be very low. The majority of contamination was identified in Made Ground and upper granular Tidal Flat Deposits. Contamination in the deeper underlying Tidal Flat Deposits and Mudstone are limited and localised, indicating that vertical migration into these units is limited.
Modelling Approach	The Groundwater Source was modelled in the SBA DQRA (Arcadis, 2021d), which concluded that measured concentrations from the modelled Groundwater Source did not

	represent a significant risk to the primary water resource receptor (River Tees). As no changes have been made to the conceptual understanding of this area, and no additional groundwater monitoring has been undertaken, the findings of the SBA DQRA were considered to remain valid and not re-assessed. As such, only the Made Ground Source was assessed in this DQRA. Made Ground was identified as present across the site and likely present immediately adjacent to the River Tees. This is considered a conservative assumption, given a sheet pile wall may be present in future, potentially reducing the flow of groundwater from the site towards the river. A lateral migration pathway along which contaminant attenuation may occur was not modelled. Groundwater was identified resting within the base of the Made Ground. Due to the relatively high permeability of the Made Ground compared to the underlying natural geology, Made Ground was modelled as the primary unit from which discharge into the River Tees occurs. The assessment was undertaken in two stages, with the second stage undertaken dependent on the outcome of Stage 1: 1. Measured concentrations of contaminants in groundwater representing those with potential to enter the River Tees were directly compared with saline EQS. 2. Further to this, Site Specific Assessment Criteria (SSAC) were calculated taking into account a dilution factor within the River Tees. The assessment was undertaken based on contaminants measured above the laboratory method detection limit (MDL) in 67 wells sampled to date from across the site. Measured concentrations of contaminants from the 67 groundwater monitoring wells sampled from across the site were compared to the assessment criteria as an initial assessment. Seventeen monitoring wells were installed along the northern boundary of the site, prior to the River Tees. These were described in the DQRA as “sentinel wells” and are considered to provide the best representation of groundwater potentially entering the River Tees due to their location at the northern of the site - in particular those screening Made Ground and upper granular portions of the Tidal Flat Deposits. As such, the groundwater quality data specifically from the sentinel wells were used to further discuss the potential risk presented to the receptor (River Tees), based on the findings of the initial assessment. Given the diffuse nature of contamination in the Made Ground from across the site, the absence of significant spatial distribution trends, the relatively permeable nature of the Made Ground, absence of hardstanding and the significant length of time the Made Ground has been present, concentrations of contaminants in sentinel wells were considered unlikely to increase further over time and to be at “steady state”. This supported the use of the sentinel wells to further evaluate the risk to the River Tees from the site.
Water Resource DQRA Outcome	**Stage 1** Multiple CoC including metals and inorganics, hydrocarbons and organic compounds exceeded the EQS in groundwater in both the sentinel wells and from the wider site. This represents a point of compliance immediately prior to the River Tees. **Stage 2** Dilution in the receiving surface water body (River Tees) was further considered by the calculation of groundwater-surface water SSAC. This assessment indicated that a limited number of contaminants, sampled from the 67 wells from across the site, exceeded the SSAC derived including hydrocarbons (TPH and PAH), phenols, cyanide, thiocyanate and ammoniacal nitrogen. Several of the site wide wells where the SSAC were exceeded, were in the area of the SBCO or hydraulically down gradient. Review of the distribution indicated that the contaminants exceeding the SSAC in these wells were likely associated with a localised source around SBCO, rather than the Made Ground across the site. The majority of the

	contaminants in this area were assessed in the SBA DQRA (Arcadis, 2021d) which concluded that a significant risk to water resources was not present based on the attenuation occurring during lateral migration and subsequent dilution in the River Tees. Review of the remaining wells (excluding sentinel wells) indicated that a single contaminant was exceeding at most locations, in some instances during only one out of three visits. These locations were relatively distant from the River Tees and screening lower permeability natural geology. The influence of concentrations associated with these wells on down gradient groundwater quality and the River Tees was considered to be limited. Further assessment of the potential risk to the River Tees was undertaken by comparison of measured concentrations from the 17 sentinel wells only, representing potential concentrations entering the river. Ammoniacal nitrogen, thiocyanate and benzo(a)pyrene exceeded the SSAC in the sentinel wells. Across the three monitoring rounds, measured concentrations of ammoniacal nitrogen, thiocyanate and benzo(a)pyrene exceed the SSAC with dilution in seven, five and two out of the 17 locations monitored respectively. The SSAC for thiocyanate and ammoniacal nitrogen were reviewed based on the localised nature of the contamination identified by the reduction of the source width (from 5,000m to account for Made Ground across the wider Redcar site to 800m and 500m to account for a source specific to South Bank for ammoniacal nitrogen and thiocyanate respectively). Review of the revised SSAC in combination with additional lines of evidence (including review of compliance criteria and conservatisms in dilution approach used) indicated that measured concentrations of ammoniacal nitrogen and thiocyanate do not present a significant risk to the River Tees. Benzo(a)pyrene exceeded the SSAC in two of the sentinel wells. Further assessment of the three rounds of monitoring undertaken indicated that concentrations were generally below the SSAC and only marginally above on a single occasion and therefore unlikely to present a significant level of risk to the River Tees.
Conclusions	Based on the findings of the SBA DQRA (Arcadis, 2021d) and the review of the CSM undertaken in this DQRA, the Groundwater Source in the area of SBA_AUK_BH110 (interpreted to be associated with the SBCO), is not considered to present a significant risk to the identified water resource receptor (River Tees). The findings of the water resource assessment for the Made Ground Source undertaken in this DQRA concludes that the site does not present a significant risk to the identified water resource receptor, the River Tees. This assessment supersedes the assessment of the Made Ground source undertaken in the first issue of the SBA DQRA (Arcadis, 2021d). The findings of this DQRA concur with the SBA DQRA, that the Made Ground does not present a significant level of risk to the identified water resource receptor (River Tees). The criteria developed in this assessment may potentially be used to assess other areas of the Teesworks where Made Ground is a single source. However, first a detailed conceptual review of any areas assessed in future needs to be undertaken. In particular, confirming sources, pathways and receptors remain applicable.
Other Considerations	Non-aqueous Phase Liquid has been recorded on site. This may require consideration as part of remediation works however, dissolved phase concentrations indicate that NAPL is not presenting a risk to water resources. A potential pathway due to piled foundations was identified under the pollutant linkages. Based on the findings of the contaminant distribution and underlying ground conditions, it is considered unlikely that this pathway could represent a significant risk to water resources. Although contamination may locally be able to enter the underlying natural deposits around piles, lateral migration within the unit is unlikely to be significant.

It is recommended that risks to human health are also considered at the design stage of any proposed redevelopment based on the findings of the GQRA with regards to dermal, ingestion and inhalation pathways.

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1 Introduction

Arcadis Consulting (UK) Limited (Arcadis) was commissioned by South Tees Development Corporation to undertake a Detailed Quantitative Risk Assessment (DQRA) at the South Bank Area (SB, "the site"), situated at the Teesworks, located within the industrial area generally known as 'South Tees', TS10 5QW (indicative postcode).

The site location plan is presented on Figure 1, which also indicates the main areas of the site.

1.1 Background

The South Bank Area comprises three main areas, A, B & C (SBA, SBB and SBC), which have each been investigated as part of a site wide strategy for assessing the South Bank Area and wider South Tees development area. It also encompasses the recently investigated South Bank Coke Ovens (SBCO) area which lies predominantly within SBA, with a portion in SBC and a portion outside both SBA and SBC. The SBB area encloses a plot of land leased by Tarmac (Hanson Concrete) which was not included in the investigations.

This report follows on from Environmental Site Assessment (ESA) reports for the three main areas of South Bank. The ESA for SBA, SBB and SBC include a Generic Quantitative Risk Assessment (GQRA) undertaken by Arcadis (Arcadis, 2021a; 2021b & 2021c). A Ground Investigation and GQRA Report was also undertaken by Royal Haskoning (Royal Haskoning, 2021) which covers the quayside areas of SBA and SBB.

A DQRA was undertaken by Arcadis for SBA (Arcadis, 2021d) after completion of the ESA for SBA and quayside investigation by Royal Haskoning. This DQRA builds on the findings of the SBA DQRA, encompassing the wider area SB site. In addition to the wider area scope of this DQRA, trial pit investigations in the SBCO area have also recently undertaken (Arcadis, 2021c). In the SBA DQRA (2021d), the SBCO area was a data gap.

This report should therefore be read in conjunction with the three Arcadis ESA reports, Royal Haskoning Ground Investigation report and SBA DQRA.

This DQRA further assesses the potential risk to water resource receptors from contaminants of concern (CoC) identified in the GQRAs that have exceeded the water quality standards (WQS). The potential risk to human health is discussed but is not further assessed based on the findings of the GQRA and project status.

All works have been carried out in reference to English legislation and regulatory guidance for the assessment of land contamination.

1.2 Planning Process

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

The Masterplan has identified SB (also formerly known as Cleveland North) as being located within the Southern Industrial Zone. The site is a priority development area and Arcadis understands outline planning has been submitted for "demolition of existing structures on site and the development of up to 418,000 sqm (gross) of general industry (use class B2) and storage or distribution facilities (use class B8) with office accommodation (use class B1), HGV and car parking and associated infrastructure works all matters reserved other than access" (Ref. R/2020/0357/OOM).

Planning has also been granted 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” (R/2019/0427/FFM).

This report is to be used to support the ongoing planning process at the site.

1.3 Objectives

The objective of this DQRA is to further assess the CoC identified as exceeding the relevant WQS in the GQRAs undertaken by Arcadis and Royal Haskoning. The DQRA focuses on potential risks to water resources, specifically, the River Tees which is located just beyond the northern border of the site. This report will help refine the present conceptual site model (CSM) and define potential risks posed to the River Tees by the measured concentration of CoC in groundwater. This should in turn inform any remedial strategy that may be required based on the outcome of the DQRA and the planning process.

1.4 Scope of Works

The scope of works to meet the objectives comprised the below undertakings.

Production of a DQRA:

- Assessment of the potential risk posed to water resources using a source-pathway-receptor approach to refine the existing CSM; and,
- Evaluation of the need for remediation works to be undertaken.

1.5 Reliability of Information / Limitations

The following scenarios are not considered in the derivation of site-specific assessment criteria (SSAC):

- Risks to Construction Workers – any redevelopment and construction work should be conducted in full recognition of HS(G)66 (no longer current but has not been updated and is cited in The Building Regulations, 2010) and with reference to CIRIA Report 132; and,
- Nuisance health effects – the Statutory Nuisance Act considers olfactory impacts from odours and allows comparison of enclosed space air concentrations with odour threshold concentrations.

Arcadis’ liability, pursuant to the terms of the appointment of Arcadis by South Tees Development Corporation, is strictly limited to the work undertaken and the matters contained and specifically referred to in this report.

A copy of Arcadis’ Study Limitations is presented in Appendix A.

1.6 Reliance

It is understood that the current report has been prepared for the use of South Tees Development Corporation in their planning process. The contents of this report may not be used or relied upon by any person other than this party without the express written consent and authorisation of Arcadis.

2 Summary of Previous Environmental Work

2.1 Previous Environmental Works

Previous reports issued by Arcadis in relation to the site:

- Arcadis, 2021a. Environmental Site Assessment, March 2021, Ref: 10035117-AUK-XX-XX-RP-ZZ-0192-01-SBA_ESA Review
- Arcadis, 2021b. Phase II Environmental Site Assessment (Draft), July 2021, Ref: 10035117-AUK-XX-XX-RP-ZZ-0317-01-SBB_ESA
- Arcadis, 2021c. Phase II Environmental Site Assessment (Draft), July 2021,10035117-AUK-XX-XX-RP-ZZ-0318-01-SBC_ESA
- Arcadis, 2021d. Detailed Quantitative Risk Assessment, May 2021, Ref: 10035117-AUK-XX-XX-RP-ZZ-0270-01-SBA_DQRA

Arcadis was provided with the following third-party reports:

- Royal Haskoning, 2021. South Bank Quay – Ground Investigation and Generic Quantitative Risk Assessment Report, dated 16th April 2021, Report Ref: PC1084-RHD-ZZ-XX-RP-Z-0001
- CH2M, 2017. 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
- Wood, 2019. 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
- Enviros, 2004. Soil and Groundwater Baseline Characterisation Study, Teesside Works, prepared by Enviros for Corus UK Ltd, Comprising:
    - Volume 1 – Factual Report, Ref. Rlp250604corusteessidefactual.Doc dated 25th June 2004 and marked Final;
    - Volume 2 – Interpretive Report Ref. Mwicorusdraftinterpretivemmdv#2.Doc dated 25th June 2004 and marked Final; and,
    - Volume 3 – Summary Report dated June 2004.
- AEG, 1999. South Tees Industrial Area – Site C – Ground Investigation, prepared by Allied Exploration and Geotechnics Ltd. for English Partnerships, ref 1715H dated 12th July 1999 and marked Draft.

The site is also considered in:

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

As listed above, in addition to the recent 2020/2021 investigations by Arcadis and Royal Haskoning, investigations were also completed in 2004 and 1999 by Enviros and AEG respectively. Given the age of these investigations, and the spatial coverage of the recent 2021 investigations, the findings of the 2004 and 1999 investigations have not been discussed in detail below.

2.2 Summary of 2020/2021 Ground Investigations Scope

The three ESA reports for SBA, SBB and SBC prepared by Arcadis (Arcadis, 2021a, 2021b & 2021c) encompass the majority of the site footprint. The ESA report for SBA includes an additional trial pit

investigation in the SBCO area. The Ground Investigation and GQRA Report prepared by Royal Haskoning (Royal Haskoning, 2021) encompassed the quayside area in the north of the SBA and SBB areas of the site.

Arcadis (2021a), completed in the SBA area, comprised the following scope:

- 49 trial pits to 4.5m below ground level (bgl);
- Soil logging and sampling from 14 additional trial pits in the SBCO area, to a target depth of 4.5m bgl
- Nine boreholes advanced by rota-sonic rig to depths between 10m – 20m bgl, three of these were advanced 5m into the underlying bedrock;
- Soil logging and sampling;
- Installation of 15 groundwater monitoring wells (six dual installations);
- Groundwater monitoring and sampling (4no. rounds) as well as aquifer permeability testing and tidal monitoring from 10 wells installed;
- Groundwater monitoring and sampling (1no. round) of 13 quayside wells; and,
- Permanent ground gas monitoring.

Arcadis (2021b), completed in the SBB area comprised the following scope:

- 46 trial pits, excavated to a target depth of 4.5m or refusal, or until natural material was encountered;
- Nine boreholes drilled by rota-sonic rig, with target depths of between 10m - 20m bgl, or refusal on bedrock, three of these boreholes were advanced 5m into the underlying bedrock;
- Soil logging and sampling;
- Installation of 18 groundwater monitoring wells (including nine dual installations);
- Groundwater monitoring and sampling (3no. rounds) from 17 wells installed;
- Groundwater monitoring and sampling (1no. round) of 4 quayside wells; and,
- Permanent ground gas monitoring (1no. round).

Arcadis (2021c), completed in the SBC area comprised the following scope:

- 55 trial pits, excavated to a target depth of 4.5m or refusal, or until natural material was encountered;
- 16 boreholes drilled by rota-sonic rig, with target depths of between 10m - 20m, or refusal on bedrock, three of these boreholes were advanced 5m into the underlying bedrock;
- Soil logging and sampling;
- Installation of 25 groundwater monitoring wells (including nine dual installations);
- Groundwater monitoring and sampling (3no. round) from 23 wells installed; and,
- Permanent ground gas monitoring (1no. round).

Royal Haskoning (2021), completed in the Quayside area, comprised the following scope:

- 25 boreholes advanced by rota-sonic rig to a maximum depth of 41m bgl;
- Soil logging and sampling;
- Installation of 17 groundwater monitoring wells; and,
- Groundwater and surface water monitoring and sampling (2no. rounds).

A monitoring well location plan for the above installations is presented as Figure 2 which includes all of the monitoring wells where groundwater sampling was undertaken. In total, 67 wells were monitored. These relate to a total of 52 locations as a number of the locations were dual installations.

2.3 Summary of Site History

The ESA reports outline the history of the site and its immediate surroundings, used as part of the CSM development. The below table summarises the history of the site based on the available information identified by Arcadis:

Date	Description
1856	The site was predominantly mud, sand and marshes associated with the Tees Estuary and below the high tide limit. A railway line is present to the south of the site.
1893	The site is still shown as estuarine mud with two jetties crossing to the river in the west. South Bank Iron Works and Phosphate Manure Works have been constructed on site in the SBC area.
1913 - 1938	The site appears to have been reclaimed from the Tees Estuary by the placement of materials from the steelmaking process. The Phosphate Manure Works is now a basic slag works. Various structures are shown on site in the SBA and SBC area including railways, cranes, a pumping station, brine wells / salt works, blast furnaces, galvanising works, and tanks later labelled as containing benzol. Two large reservoirs are shown between 1913 and 1927 in the SBA area along with Benzol tanks. A tarmacadam works is identified to the west of SBC.
1955	The SBA area primarily comprised of stocking areas with sidings and travelling cranes present. The benzol tanks are still shown. There has been development to the south of SBA with a concrete plant, and the basic slag works on SBC. SBC has undergone further development with the construction of two ore grading plants and a sinter plant along the southern site boundary. Sub-stations are noted as being located centrally and directly north of the basic slag plant. The South Bank Iron Works has expanded to the west of site. The tarmacadam works is no longer present.
1965	The South Bank Coke Ovens and Biproducts Plant (SBCO) has been built immediately to the south of SBA in its present-day format with tanks.
1969	An oil depot (current day HFO tanks) has been developed on SBB, along the northern boundary with the River Tees. More rail sidings to the south and west of SBB have been developed.
1970	Sidings are present down much of the west of SBA and centrally on SBC and the large building currently being demolished on SBA is labelled as a ferro-manganese crushing plant.
1990	Between the 1990s and present, a Hanson Concrete depot has been developed on a plot of land enclosed by SBB. SBB is predominantly used for stockpiling of material. During this time, buildings recede from SBC and the modern-day configuration reached. The interior of the site is disused and barren.

The industrial history of the site and its surroundings highlights the potential for contaminant sources to be present from the Made Ground material used to build up the land when it was reclaimed from the estuary, as well as from other specific sources relating to on-site and off-site industrial operations.

2.4 Summary of Ground Conditions

The below table summarises the ground conditions encountered during the 2020 and 2021 investigations reported in Arcadis, 2021a, 2021b & 2021c which encompasses the majority of the site footprint. Ground conditions remained generally consistent across the three main areas of the site. Ground conditions encountered in the quayside area, reported in Royal Haskoning, 2021, were found to be in line with the below:

Unit	Minimum Basal Depth (m bgl)	Maximum Basal Depth (m bgl)	Comment
Made Ground	2.6	11.7	Site surfacing comprised either soft standing of gravel, sand, or slag with concrete and bituminous surfacing also present in SBB and SBC. The Made Ground encountered during the investigation predominantly comprised granular material with a fine-grained component and medium to high cobble/boulder content which included slag, brick, concrete and occasionally clinker, coke, coal and/or metal. Rare to frequent refractory materials were identified in a number of trial pits across the site in SBA. Based on visual assessment slag was found to be the dominant component of Made Ground in 50 of 58 locations in SBA, all 55 locations in SBB and 50 of 55 trial pit locations in SBC. From the 14 additional trial pits in the SBCO area, slag was the dominant component at all 14 locations. In one location in SBA and six locations in SBC, a concrete slab was identified between 0 and 1.5m bgl. In 11 locations (predominantly in the south-western corner of SBB) a layer of granular made ground coloured green blue was identified. All trial pits were terminated within the Made Ground.
Tidal Flat Deposits (Secondary A Aquifer)	6.1	16.9	Encountered in 33 of 34 boreholes (except SBC_AUK_BH105). Generally comprised soft sandy silt (often shelly) frequently underlain by a silty sand. Identified to be widely distributed across the site below the Made Ground.
Glaciolacustrine Deposits (unproductive strata)	7.2	19.2	Glaciolacustrine Deposits were recorded below the Tidal Flat Deposits in seven boreholes from SBA and 15 boreholes from SBC. The deposit was noted to be less than 1m thick in SBA_AUK_BH103 and SBA_AUK_BH107. The deposits were generally described as a soft to firm brown laminated clay often with sand partings along laminations. In one location SBA_AUK_BH105 two units of Glaciolacustrine deposits were noted with Glacial Till in between.
Glacial Till (unproductive strata)	9.8	26.25	Glacial Till was identified in 31 of 34 boreholes below the Glaciolacustrine Deposits (if present) or Tidal Flat Deposits. Glacial Till was described as a firm to very stiff red brown slightly sandy slightly gravelly clay, with gravel composed of mixed lithologies, including sandstone, mudstone, and limestone. Glacial Till is distributed widely across the site overlying the bedrock.

Unit	Minimum Basal Depth (m bgl)	Maximum Basal Depth (m bgl)	Comment
			In one location SBA_AUK_BH105 two units of Glacial Till were present the upper layer interbedded between Glaciolacustrine deposits
Sand and Gravel (suspected to be a granular lens at the base of the Glacial Till)	19	22.4	Sand and Gravel was identified in two boreholes from SBA. Two bands of suspected granular lens were noted in SBA_AUK_BH105 below the lower band of Glaciolacustrine Deposits and below the Glacial Till Deposits, and in SBA_AUK_BH102 it was noted below the Glacial Till. The Sand and Gravel was described as a clayey Sand and Gravel with gravel composed of mixed lithologies, including sandstone, limestone, flint and chert.
Mercia Mudstone	16.5	31.5	An extremely weak to weak red brown mudstone partially to highly weathered with numerous bands of white gypsum and locally green grey glauconite, recorded in 27 boreholes. The Mercia Mudstone was noted to become interbedded mudstone, sandstone and siltstone at depth within some boreholes.

Two types of Made Ground were noted:

- Slag-dominant material (>50% slag): Generally ranging from gravel to cobble and occasional boulder size fragments. The slag material was generally vesicular and grey-green-white in colour. Slag dominant Made Ground was identified to comprise the primary Made Ground in 42 of the 49 trial pits from SBA, all 46 trial pits in SBB, 48 of the 53 trial pits in SBC and all 14 of the additional SBCO area trial pits.
- Granular Made Ground: Identified widely across the site of varying composition, most frequently a sandy gravel with varying cobble content. Gravel and cobbles include brick (including refractory), concrete, ash and clinker, slag was not the dominant constituent although often still present within the soil matrix.

2.5 Summary of Hydrogeological Conditions

The site overlies Tidal Flat Deposits and the Mercia Mudstone, both of which are designated as Secondary A and Secondary B aquifers, respectively. The remaining units identified are classified as unproductive strata.

The groundwater underlying the site was found to be consistently resting within the Made Ground, generally towards the base 1m (range of 0.4m – 2.0m) of the Made Ground (thickness encountered of 2.6 to 11.7m, mean 7.61m). This corresponds with a resting water level range of 1.69m – 10.34m bgl (mean 6.1m bgl). C Concentrations of contaminants in soil from the greater depths of the Made Ground and from the Tidal Flat Deposits beneath are therefore saturated.

The Tidal Flat Deposits are present continuously across the site but in locations are of limited thickness. Although classified as Unproductive Strata, the site data indicates the potential for horizontal and vertical migration of groundwater within more permeable horizons of the Glaciolacustrine Deposits and Glacial Till. The underlying bedrock is considered the most sensitive aquifer system at the site, with a groundwater flow direction towards the northeast inferred from site data.

Assessment of the groundwater level data indicates that the water level in wells screening the bedrock aquifer is above the slotted section, and water level is resting within the Made Ground. This indicates that the

groundwater is not confined and may be in hydraulic continuity with groundwater within the groundwater within the Made Ground and Tidal Flat Deposits.

Groundwater flow was inferred to be toward the north or north-east within both the Made Ground and Tidal Flat Deposits, towards the River as would be expected.

A tidal influence measured in some of the on-site wells, and the lack of a current sheet pile wall or physical barrier between the site and River Tees, indicates that the groundwater migration pathway to the River and Estuary is likely to be active. A maximum tidal influence range of 4cm was measured in Tidal Flat Deposits. Tidal influence in Made Ground was not measured to date but is anticipated to be greater.

2.6 Summary of Hydrology

The River Tees is present approximately 20m to the north of the site boundary. The River Tees is a tidal estuary, flowing towards the northeast. The Teesmouth and Cleveland Coast is also a designated Ramsar site, Site of Special Scientific Interest (SSSI) and a Special Protection Area (SPA).

2.7 GQRA Conclusions

2.7.1 Human Health

The conclusions of the GQRAs undertaken for SBA, SBB and SBC were that concentrations of arsenic, lead, benzene, dibenzofuran, 1,2 dichloroethane and PAHs were measured exceeding the Generic Assessment Criteria (GAC) in soil. Concentrations of contaminants were not measured above the GAC derived for the protection of human health in groundwater. Non aqueous phase liquid (NAPL) and tar were identified primarily within the Made Ground in three locations from SBA, one from SBB, four from SBC and two from the additional SBCO area investigation.

Asbestos was recorded in seven of the Made Ground samples from SBA, three from SBB and 11 from SBC. Asbestos poses a potential risk to human health via inhalation of loose fibres and has implications for remedial costs.

Permanent ground gas monitoring completed to date showed the risk from permanent ground gases to be very low.

The reports concluded that the potential risks to human health could be reassessed further when a redevelopment scenario and proposed site levels have been fully defined.

The Royal Haskoning April 2021 report highlighted elevated levels of arsenic exceeding human health GAC in soils from the boreholes drilled along the northern edge of the site as part of a ground investigation to inform the design of a sheet pile wall. Their report concluded that soils in those boreholes do not pose an unacceptable risk to future commercial users.

The findings of the GQRAs currently provide an appropriate level of assessment of the potential risk to human health based on what is known of the planned redevelopment scenario. The findings of the GQRA indicate the potential risk to human health can likely be managed by pathway management, such as simple cover systems, hardstanding, positioning of on-site buildings and suitable vapour membranes, or by target localised removal of soils. Further human health assessment has therefore not been undertaken at this stage.

2.7.2 Water Resources

Several exceedances of Water Quality Standards (WQS) by measured concentrations of contaminants in groundwater were recorded on site, primarily relating to those wells screening the Made Ground and the Tidal Flat Deposits. The GQRAs recommend further assessment in relation to controlled waters and ecological

receptors (River Tees and Teesmouth and Cleveland Coast SSSI) but noted the limited resource value of the underlying aquifers.

Dense Non-Aqueous Phase Liquid (DNAPL) was measured in SBA_AUK_BH110 in two of the three groundwater monitoring visits. This, along with other CoC, could not be fully delineated as part of the initial SBA ESA due to the presence of an exclusion zone on site relating to the instability of the ammonia scrubbers on the SBCO site to the south. This was highlighted as a potential data gap in the SBA DQRA. The 14 additional trial pits advanced in the SBCO area following the SBA DQRA provide further assessment of the soil quality in this previously investigated area.

The proximity of the site to the River Tees (approximately 20m north of the site boundary) has resulted in a tidal influence in some of the monitoring wells and this should also be considered.

The Royal Haskoning April 2021 report also shows detections of the same CoC highlighted within the Arcadis 2021a, 2021b & 2021c reports within the groundwater in the wells running along the northern site boundary. They also highlighted a potential for DNAPL to be present within BH2025, although this was not measured or sampled during the works but rather based on observations during drilling and contaminant concentrations within the soil and groundwater. The source of the impacts in BH2025 is not known as is speculated to perhaps be an off-site source.

2.8 South Bank A DQRA Summary

The SBA DQRA undertaken by Arcadis (Arcadis, 2021d) further assessed the potential risk to water resource receptors based on data from Arcadis (2021a).

A brief summary of the DQRA is provided below.

2.8.1 Sources

The DQRA assessed the risk to water resources based on two separate sources:

- **Made Ground Source** from across the site – considered to comprise a single diffuse soil source associated with Made Ground and slag.
- **Groundwater Source** in the vicinity of SBA_AUK_BH110 – considered to represent contamination associated with SBCO to the south.

2.8.2 Pathways

The environmental fate and transport pathways modelled within the DQRA were:

- **Groundwater Source:** Lateral migration of potentially impacted groundwater within Made Ground towards the identified water resource receptors and subsequent dilution with the receptor.
- **Made Ground Source**: Dilution with the receptor.

Additionally, vertical migration of impacts down relic foundation piles was also qualitatively assessed.

2.8.3 Receptors

The water resource receptors assessed in the DQRA were:

- The River Tees

The primary water resource receptor associated with the site was considered to be The River Tees, although a theoretical compliance point with the aquifer was also assessed in line with the EA guidance for hazardous substances (EA, 2017).

The underlying Tidal Flat Deposits and the Mercia Mudstone are designated as a Secondary A and Secondary B Aquifers, respectively. The remaining units identified are classified as unproductive strata. However, the DQRA considered that due to the aquifer characteristics, the industrial history of the site and its surroundings, as well as the brackish nature of the groundwater due to proximity to the estuary, groundwater abstraction for potable water is unlikely to be considered in the future. The resource potential for the underlying aquifers was therefore considered to be very low.

Furthermore, assessment of the contaminant distribution indicated that the majority of contamination was restricted to the Made Ground. Contamination in the underlying Tidal Flat Deposits and Mudstone were limited and localised, indicating that vertical migration into these units is limited. Given that the Made Ground represents reclaimed land, it is unlikely to be considered as a receptor under the aquifer classifications and would instead represent a pathway towards surface water.

2.8.4 Assessment Approach

Remedial Targets Worksheet (RTW) was used to derive Site Specific Assessment Criteria (SSAC) for groundwater using site-specific information, where available. Dilution with the River Tees was also calculated in line with the Remedial Targets Methodology (RTM) guidance.

The dilution assessment based on RTM guidance only allowed for a limited amount of dilution (actual dilution occurring likely much higher). 10% of compliance concentrations (saline environmental quality standards [EQS]) were taken in line with guidance to add further conservatism.

The assessment considered three separate compliance points, for which SSAC were derived:

- On-site 50m compliance point, protective of aquifers and surface water (assessed for the Groundwater Source only)
- Prior to the River Tees (at sentinel wells and 360m down gradient from the Groundwater Source); and
- Within the River Tees (dilution in the receptor; both Sources)

2.8.5 DQRA Findings

50m Compliance Point (Groundwater Source only)

The 50m compliance point was modelled for the groundwater source as a first stage of assessment in line with EA guidance for hazardous substances. This compliance point was located on site (down gradient boundary approximately 310m beyond). Aquifers underlying the site were considered of limited resource potential. Furthermore, the evidence from site data indicated that contamination was not migrating downwards significantly into the underlying aquifers and was generally limited to the overlying Made Ground (reclaimed land). As such, although a number of hydrocarbons and cyanide exceeded the 50m SSAC derived, measured concentrations were not considered to present a significant risk to water resources on this basis alone. Assessment of a more distant compliance point protective of the River Tees provided a more accurate appraisal of the risk to water resources.

Compliance Point Prior to the River Tees (at Sentinel Wells and 360m down gradient from Groundwater Source)

From the Groundwater Source, cyanide, naphthalene and benzene were the only CoC compounds to exceed the SSAC. Naphthalene and benzene exceeded by less than an order of magnitude. Given the conservatism in the assessment (as demonstrated in the model validation undertaken within the DQRA), and assumptions in modelling cyanide, the risk presented by these CoC within the groundwater source was considered to be low.

Measured concentrations of a number of CoC in groundwater in sentinel wells exceeded EQS including TPH, metals, inorganics and PAH. This was not unexpected given that some of the sentinel wells were installed

directly screening the Made Ground. As Made Ground forms the boundary with the River Tees, concentrations were considered likely to be similar immediately adjacent to the River. The presence of future structures such as sheet piled walls (potentially installed as part of redevelopment works) would go some way to limit the amount of groundwater discharge from the site into the River Tees.

Compliance Point within The River Tees (dilution in the receptor)

None of the measured concentrations of CoC in the on-site Groundwater Source wells or the sentinel wells (located along the hydraulically down gradient northern site boundary) exceeded their respective SSAC when dilution within the River Tees was considered.

Given the margin by which concentrations fell below the criteria, contaminant concentrations in the River Tees were considered unlikely to exceed measurable concentrations due to inputs from on-site sources.

Surface water monitoring data from the River Tees is provided in Royal Haskoning 2021. The findings of the surface water sampling are considered to support the above conclusions.

Other Considerations

It was understood the SBCO plant to the south was likely to be demolished with a ground investigation and remedial works to be undertaken at the site. It was concluded as likely that, once this has been carried out, contaminant concentrations beneath SBA would decrease, particularly within SBA_AUK_BH110 and the Groundwater Source area, from where the highest measured groundwater concentrations of CoC were sampled.

The modelling showed that sufficient time may not have yet elapsed for contaminants to have reached a steady state equilibrium with groundwater (in relation to the groundwater source). A timeframe assessment for the Groundwater Source predicted that measured concentrations may increase by around an order of magnitude from present day (assumed around the 50yr timeframe modelled) to steady state (approximately 190yrs or greater). Given this, and the current measured concentrations in the sentinel wells, it was concluded that measured sentinel well concentrations would still remain well below their SSAC (considering dilution in the River Tees) into the future.

NAPL has been recorded on site. It was concluded that this may require consideration as part of remediation works for the purposes of environmental betterment. However, dissolved phase concentrations indicated that NAPL was not presenting an unacceptable risk to water resources.

A potential pathway due to piled foundations was identified under the pollutant linkages. Based on the findings of the contaminant distribution and underlying ground conditions, it was considered unlikely that this pathway could represent a significant risk to water resources. Although contamination may locally be able to enter the underlying natural deposits around piles, lateral migration within the unit was concluded unlikely to be significant.

3 Potentially Active Pollutant Linkages

Potential sources of contamination exist on site associated with the Made Ground and historical use of the site.

The potentially active pollutant linkages are discussed below, based on the findings of the ESA reports and GQRAs undertaken, and following the SBA DQRA.

3.1 Human Health

Based on the intended industrial / commercial end use of the site, future on-site commercial workers and construction workers are considered as the primary human health receptor. A human health GQRA has been undertaken and is considered to provide an appropriate level of assessment based on what is known of the planned redevelopment scenario. Therefore, human health will not be assessed further within the DQRA, as discussed in Section 2 above. It is recommended that risks to human health are considered at the design stage of any proposed redevelopment with regards to dermal, ingestion and inhalation pathways.

To summarise, the following pollutant linkages are considered potentially active in relation to human health receptors:

- Inhalation or ingestion of dust comprising contaminated soils, including asbestos fibres, in indoor or outdoor air.
- Dermal contact with contaminated soils.
- Inhalation of vapours in indoor or outdoor air arising from contaminated soils.

3.2 Water Resources

The site overlies Tidal Flat Deposits and the Mercia Mudstone, both of which are designated as Secondary A and Secondary B aquifers, respectively. The remaining units identified are classified as unproductive strata. The pathway of leaching of CoC from impacted soils and migration into groundwater is potentially active due to the absence of hardstanding on the site and active process of infiltration from rainwater. Groundwater is resting with the Made Ground beneath the site, which is of a higher permeability that the underlying natural deposits.

The River Tees is present approximately 20m to the north of the site boundary and groundwater migration pathway to the River and Estuary is likely to be an active pathway.

As concluded in the SBA DQRA (Arcadis, 2021d), due to the limited resource value of the underlying aquifers based on the industrial site setting, low permeability of the Tidal Flat Deposits & the Mercia Mudstone and the brackish nature of the water, it is considered unlikely that groundwater would be abstracted for drinking purposes. As such, the use of saline environmental quality standards (EQS) as opposed to drinking water standards (DWS) are considered most appropriate for assessing the risk to water resources, based on protection of estuarine surface water (River Tees) as of primary concern.

A NAPL source within the groundwater has been recorded in SBA_AUK_BH110 towards the southern boundary of the site. While the NAPL has not been encountered in surrounding wells, a dissolved phase plume located north towards the River Tees from the SBA_AUK_BH110 area is present. The NAPL was found resting on the boundary between the Slag Made Ground and the Tidal Flat deposits.

The groundwater source identified in the vicinity of SBA_AUK_BH110 is considered to form a potentially active pollutant linkage with the River Tees via the lateral migration pathway (mainly thorough the saturated Made Ground). This pathway was assessed as part of the SBA DQRA (Arcadis, 2021d) and found not to

represent a significant risk to water resources based on measured groundwater concentrations. As such, the significance of this pathway will be reviewed based on the additional data available and only assessed if a change to the CSM is required.

To summarise, the following pathways are considered potentially active in relation to water resource receptors:

- Leaching of CoC from soil into groundwater.
- Migration in groundwater through the Made Ground towards the surface water receptor (River Tees).
- Vertical migration of impacts down relic foundation piles is also considered potentially active.

4 Site Characterisation

4.1 Environmental Setting

The environmental setting of the site is summarised on Figures 1 and 4. Figure 1 identifies potentially sensitive land uses in the vicinity of the site, alongside identified environmental receptors located hydraulically down-gradient. Figure 4 includes a simplified profile of the geological conditions, alongside a conceptual cross-section identifying potentially active pollutant linkages.

4.2 Sources

4.2.1 On-Site Sources

Arcadis 2021a, 2021b and 2021c identified the following as potential on-site sources of contamination:

- Made Ground including slag
- South Bank Coke Ovens (SBCO)
- Benzol plant
- Iron / Galvanizing works
- Ferro-manganese plant
- Stocking area, railways and sidings
- Above ground storage tanks (various, including Heavy Fuel Oil [HFO] tanks) and HFO line
- Transformers and substations
- Infilled reservoir and pond
- Basic Slag Works
- Phosphate works

Made Ground

The entirety of SB is reclaimed land from the River Tees Estuary. The Made Ground used for the land reclamation is primarily composed of by-products from surrounding industrial processes, including slag. The Made Ground has therefore been considered as a single diffuse source of CoC across the entire site.

Contaminants primarily associated with Made Ground are found dispersed throughout the site in varying concentrations. Diffuse contaminants found throughout the site associated with Made Ground include metals, hydrocarbons including PAH, inorganics including cyanide, ammonia and sulphate, asbestos and limited amounts of other organic compounds such as phenolics.

SBCO

The SBCO to the south of SBA was considered in the SBA DQRA (Arcadis, 2021d) to be the likely source of the highest concentrations of CoC in groundwater and NAPL measured in SBA. The SBCO is shown on historical maps to have been built around 1965 and is known to have impacted underlying soil and groundwater from the facility operation and associated tanks and infrastructure.

Associated contaminants with the potential to affect groundwater quality include metals, hydrocarbons (including tars), PAH, inorganics including cyanide, ammonia and sulphate and other volatile and semi-volatile organic compounds.

Other Potential On-Site Sources

The other potential sources, identified in addition to Made Ground and SBCO, represent more localised potential sources of historical contamination. The Benzol plant and Ferro-manganese plant were located in the

eastern portion of the site. The coal stocking area was located in the southwest of the SBA and Iron / Galvanising works in the northwest of the SBA. A number of substations were identified across the site. Various tanks were located across the site, including the decommissioned HFO tanks in the north of SBB and decommissioned HFO line runs in the north of the site. Two large reservoirs were present historically on site which were infilled. The Basic Slag and Phosphate works were located in SBC in the south of the site.

Contaminants associated with the above include metals, asbestos, hydrocarbons (including tars), PAH, inorganics including cyanide, ammonia and sulphate, polychlorinated biphenyls (PCB), asbestos and other volatile and semi-volatile organic compounds.

4.2.2 Off-Site Sources

Arcadis 2021a, 2021b and 2021c identified The High Tip and Highfield Environmental as the main off-site potential source. The High Tip is located immediately to the east of the site. Associated contaminants with the potential to affect groundwater quality include metals, hydrocarbons, PAH, inorganics including cyanide, ammonia and sulphate and other volatile and semi-volatile organic compounds.

Given the north/north-easterly groundwater flow direction, the wharf and pumphouse identified to the north of the site are unlikely to affect groundwater quality beneath the site.

Other off-site sources identified include the Tarmac leasehold, located within the SBB footprint. Associated contaminants with the potential to affect groundwater quality include metals, TPH, PAH, VOC and SVOC.

4.2.3 Contaminant Distribution

Based on the results of the recent site investigations reported in by Arcadis (Arcadis, 2021a, 2021b & 2021c) and Royal Haskoning (2021), the contaminant distribution is summarised below for key CoC. Contaminant distribution plots are also provided for key CoC, including those CoC groups exceeding EQS in sentinel groundwater wells as Figures 3a-3af.

The seventeen Royal Haskoning wells along the northern boundary of the site have been referred to as sentinel wells as they are positioned to indicate contaminant flow off-site towards the River Tees. These sentinel wells generally screen the upper portion of the Tidal Flat Deposits, comprising sand, or screen the Made Ground.

The groundwater underlying the site was generally found to be resting within the Made Ground, with the Made Ground encountered a thickness of 2.6 to 11.7m, mean 7.61m). The resting water level ranged from approximately 1.69m – 10.34m bgl (mean 6.1m bgl), with the saturated thickness of Made Ground ranging from approximately 0.4m to 2.0m. Soil impacts from the greater depths of the Made Ground and from the Tidal Flat Deposits beneath are therefore saturated.

Saturated soil and leachate samples are considered useful for assessing where contaminant mass is stored, but potential risks to water resources are considered best represented by concentrations of CoC in groundwater. As such, saturated soil and leachate samples have not been included in the discussion below. For the purpose of assessment, unsaturated soils have been defined as those above 6m bgl based on the site data.

Investigations were also completed in 2004 and 1999 by Enviros and AEG respectively. Given the age of these investigations, and the coverage of the recent 2021 investigations, findings of the 2004 and 1999 investigations have not been discussed in detail below. However, where pertinent information was identified, this has been referenced.

4.2.3.1 Non-Aqueous Phase Liquid (NAPL)

Non-Aqueous Phase Liquid (NAPL) was identified resting at the base of the Made Ground on the Tidal Flats deposits in SBA_AUK_BH110 at the southern boundary of the site. The NAPL thickness was measured on two occasions in October 2020 resting between 7.44 and 7.50m bgl (6cm thickness), and 7.16m and 7.50m bgl (34cm thickness).

NAPL was not identified by Royal Haskoning (2021). Hydrocarbon odours were noted in BH2025 and BH2021 (in the northwest and northeast of the site respectively) which the Royal Haskoning report states may be due to the presence of NAPL.

Investigations undertaken by Enviros (Enviros, 2004) also identified NAPL in two locations in the south of the site, approximately 30m from the SBCO boundary.

Observations of NAPL and tar were made primarily during intrusive investigation from within the Made Ground. These included three locations from SBA, one from SBB, four from SBC and two from the additional SBCO area investigation. However, SBA_AUK_BH110 in SBA was the only well from which a measurable thickness of NAPL was recorded during monitoring.

Within SBA (excluding SBCO area), observations of NAPL included viscous tar at 0.1-1.3m bgl in SBA_AUK_TP154, located in the north of the site in the vicinity of the HFO tanks. Further observations in SBA include SBA_AUK_BH105 and SBA_AUK_BH110 in the south of SBA where odours, sheen and tar were noted in saturated soils.

Within SBB, viscous tar was noted in unsaturated soils from SBB_AUK_TP114, located in the north of the site in the vicinity of the HFO tanks. The four observations of NAPL from SBC were at locations from across the site and within saturated soils where sheen, and odour were noted at base of the Made Ground. Within the SBCO area, tar and oil were observed in unsaturated Made Ground within SB_AUK_TP103 at 0.9m and SBA_AUK_TP116 at 1.8 to 4.0m.

4.2.3.2 Soil

Metals and Inorganics

Metals and inorganic species such as cyanide and ammoniacal nitrogen are found throughout the site (ammoniacal nitrogen only tested for in sentinel wells, in which it was measured above method detection limit [MDL] in all locations). As discussed above, this is likely due to the imported Made Ground and slag from which the site is formed. There are some locations which show higher concentrations than others, however no discernible correlation with on-site sources has been identified.

The highest total cyanide concentration was measured in SBA_AUK_TP113 at 3m bgl, located in the west of SBA (775mg/kg total cyanide, 7.69mg/kg free cyanide) The highest free cyanide concentration was measured further south in the SBCO area (9.7mg/kg from SBA_AUK_TP112 at 0.1m bgl).

The highest metal concentrations were measured at locations from across the site. The highest zinc concentration was measured in SBA_AUK_TP136 at 0.9m bgl in the east of SBA (28,000mg/kg zinc). The highest lead concentration was measured in SBC_AUK_TP168 at 2.1m bgl (3,900mg/kg) from the SBCO area in the south. The highest copper concentration (5,400mg/kg) was measured in SBC_AUK_TP111 at 0.8m bgl, located in SBC. The highest nickel concentration was measured in SBB_AUK_TP124 at 0.2m bgl, located in the north of SBB (400mg/kg).

As such, the presence of metals and inorganics is considered to predominately be a diffuse source associated with Made Ground.

Organic Compounds

Similarly to metals, PAH and TPH are found throughout the site and are also likely to be associated with the imported Made Ground and slag from which the site is formed. Again, no discernible correlation with on-site sources has been identified across the majority of the site. The highest concentrations were measured in SBA_AUK_ TP154, located in the northeast of SBA, with a maximum sum TPH of 7,970mg/kg at 0.6m bgl and maximum benzene of 23.2mg/kg. The next highest sum TPH was from SB_AUK_TP103, located in the SBCO area, with a maximum of 4,300mg/kg at 0.7m bgl. Further lower TPH concentrations were distributed across the site, with the majority of samples had TPH concentrations of less than 100mg/kg and 165 out of 193 unsaturated soils sample (187 samples out of 222 total soil samples analysed from sum TPH) reported at less than MDL.

Higher sum TPH concentrations were measured in SBA_AUK_BH110, but these were saturated so are best represented by groundwater and discussed in Section 4.2.3.3.

For PAH, the highest sum PAH concentration was measured in SBA_AUK_TP154 at 0.6m (99,000mg/kg), coinciding with the highest sum TPH concentrations in the northeast of SBA. The next highest sum PAH concentrations were measured in the SBCO area in the south of the site (15,000mg/kg in SBA_AUK_TP116 at 3.2m bgl followed by 3,400mg/kg from SB_AUK_TP103 at 0.7m bgl). The highest naphthalene and benzo(a)pyrene concentrations were also measured in SBA_AUK_TP154 at 0.6m bgl (51,000mg/kg and 2,700mg/kg respectively). Similarly to TPH, further lower sum PAH concentrations were located across the site, with the majority less than 10mg/kg and 67 out of 222 unsaturated soil samples measured at less than the MDL.

It is noted that phenolic compounds (maximum phenol 400mg/kg) were also measured at relatively high concentrations in SBA_AUK_TP154 at 0.6m bgl, when compared with other samples from the site (majority of site phenol was less than MDL).

As such, the presence of PAH and TPH in soil is considered to predominately be a diffuse source associated with Made Ground, although some potential localised areas of higher concentrations may be present.

A limited number of additional, non-hydrocarbon, organic compounds comprising VOCs were measured in unsaturated soils at isolated locations. A maximum measured concentration of 0.43mg/kg was measured of 1,2-dichloroethane (measured in a single location, SBA_AUK_TP154).

4.2.3.3 Groundwater

TPH

Sum TPH (C5-C35) was measured above the laboratory method detection limit (MDL) in 45 of the 52 groundwater monitoring well locations (98 out of 203 samples) reported in Arcadis, 2021a, 2021b, 2021c and Royal Haskoning 2021.

The highest concentration of sum TPH was measured in SBA_AUK_BH110, located in the south of SBA and screening the Made Ground, and ranged between 3,900µg/l – 76,000µg/l across the four monitoring rounds in SBA (three rounds across the rest of SB). The locations with next highest measured concentrations were all also located in the south of the site, either in the vicinity of the SBCO area or hydraulically down gradient of it. These include SBC_AUK_BH107 (9,200µg/l), SBC_AUK_BH106 (8,200µg/l) and SBA_AUK_BH105 (2,900µg/l), all screening the Made Ground. TPH was measured primarily in wells screening Made Ground hydraulically downgradient of these locations, although it was also measured in the upper Tidal Flat Deposits and occasionally in the Mercia Mudstone.

The occurrence of the majority of the measured TPH groundwater concentrations in wells screening the Made Ground indicates that this is the main pathway for lateral migration of dissolved phase contaminants.

Sum TPH was measured above the MDL 24 out of 25 wells screening the Tidal Flat Deposits (42 out of 79 samples). A maximum measured concentrations of 2,886µg/l was measured in the Tidal Flat Deposits in BH2025 (sentinel well). In BH2025, concentrations could perhaps be linked to concentrations observed in SBA_AUK_BH107 (less than MDL – 1000µg/l), or off-site sources as it is located along the western boundary of the site. SBA_AUK_BH107 screens the top of the Tidal Flat Deposits. It should be noted that the Tidal Flat Deposits in the locations with the highest concentrations have a granular component underlying the Made Ground, and therefore, contamination from Made Ground could mix vertically into the top of the more granular Tidal Flat Deposits, although it is considered likely to attenuate significantly vertically given the cohesive nature of the majority of this unit.

Concentrations above the MDL were measured in 10 out of 12 locations (18 out of 39 samples) screening the bedrock aquifer (Mercia Mudstone). Measured concentrations above the MDL ranged from 11 µg/l in SBA_AUK_BH107 in the north of SBA to 2700ug/l in SBA_AUK_BH104D in the east of SBA.

BTEX Compounds

Benzene was measured above the MDL in 13 of the 52 monitored groundwater well locations analysed for BTEX. The highest concentrations were measure in SBA_AUK_BH110, located in the south of SBA, and ranged between 24,000µg/l and 47,000µg/l across the four visits in SBA. The next highest benzene concentration of 2,100µg/l was measured in SBC_AUK_BH107, to the south of SBA_AUK_BH110 and in the vicinity of the SBCO area and screening the Mudstone.

Within the sentinel wells, benzene was only measured in two locations BH2015 at 1µg/l and in BH2025 at a maximum of 130µg/l.

Toluene, xylenes and ethylbenzene were measured above the MDL in 10 and 12 and 7 of the 52 monitored well locations respectively. Highest concentrations were again measured in SBA_AUK_BH110, with toluene ranging between 2,600µg/l – 4,500µg/l, sum xylenes measured at 468µg/l – 920µg/l and ethylbenzene measured at 37µg/l to 42µg/l across the four visits.

PAH

Total PAH was measured above the laboratory MDL in all 52 monitored locations. Again, the highest concentrations were measured in SBA_AUK_BH110, with sum PAH ranging from 6,000ug/l to 11,000ug/l across the four visits, mainly comprising naphthalene.

The sentinel wells which measured the highest total PAH concentrations were BH2010 (maximum 220µg/l) and BH2025 (maximum 800µg/l), with naphthalene also the primary component.

VOC

The highest concentrations of VOCs (excluding hydrocarbon compounds) measured above the MDL include chloroform and 1,2-dichloroethane. Chloroform was measured in nine locations at a maximum of 30µg/l (SBC_AUK_BH109). Concentrations of 1,2-dichloroethane were detected in six locations at a maximum of 85ug/l (SBA_AUK_BH104).

Within the sentinel wells, there was one location with a measured concentration of 1,2-dichloroethane and this was in BH2025 (4ug/l), and no detections of chloroform. Low level detections of other VOC were measured in the sentinel wells (maximum of 1,2-dichloropropane at 12µg/l).

Metals

Metals were measured above the laboratory MDL in all 52 groundwater monitoring well locations sampled to date. The highest concentrations of different metals were not measured consistently in any one well. The range in the majority of metal concentrations measured was generally around two orders of magnitude (maximum to minimum concentrations reported), indicating limited variability across the site.

Similarly to soils, there are some locations which show higher concentrations than others, however no discernible correlation with on-site sources has been identified. Boron is the only metal analysed where a potential spatial bias has been identified. The four highest concentrations were all measured around the north and centre of SBC (maximum 57,000µg/l in SBC_AUK_115).

Cyanide

Total cyanide was measured above the laboratory MDL in 41 of the 52 monitored well locations. It should be noted that the MDL for the analysis was higher (40µg/l) in some locations, but that an MDL of 0.1µg/l was used in the sentinel wells. This means that lower total cyanide concentrations may be more widespread that indicated by the current dataset.

The maximum total cyanide concentration was measured in SBB_AUK_BH106 of 3,800µg/l (280µg/l to 3,800µg/l across the three monitoring visits) from the centre of SBB and screening the upper Tidal Flat Deposits. The next highest total cyanide concentrations were measured in the SBCO area, with a maximum of 1,400µg/l measured in SBC_AUK_BH107 and a maximum of 690µg/l measured in SBA_AUK_BH110. This indicates that the highest measured total cyanide concentrations appear to be associated with both an area of SBB and the area around SBCO, whilst lower more widespread concentrations of total cyanide are potentially present due to the Made Ground.

Free cyanide follows a similar distribution, albeit at lower concentrations and in fewer locations. Free cyanide was measured about the MDL in 19 out of 52 locations, with a maximum of 420µg/l measured in SBB_AUK_BH106. It should be noted again that the MDL for the analysis was higher (20ug/l) in some locations, but that an MDL of 0.1µg/l was used in the sentinel wells.

Thiocyanate was measured above the laboratory MDL in 40 of the 52 monitored well locations. Maximum concentrations were measured in SBB in monitoring well location SBB_AUK_BH106, the same location as the highest free and total cyanide concentrations. Measured thiocyanate concentrations in SBB_AUK_BH106 ranged from 490,000µg/l to 1,700,000µg/l from the three monitoring visits. The next highest thiocyanate concentration was also within SBB (SBB_AUK_BH105 at 270,000µg/l maximum) with other relatively high concentrations also in a similar area. Across the rest of SB, including SBA and SBB, lower thiocyanate concentrations were more widespread, with 29 out of 37 monitoring well locations from SBA and SBB measuring less than MDL in at least one of the monitoring rounds.

Ammoniacal Nitrogen

Ammoniacal nitrogen was measured above the MDL in all 52 groundwater monitoring wells sampled to date. Measured concentrations ranged from 0.016mg/l to 360mg/l. The highest three ammoniacal nitrogen concentrations were all located in the vicinity of SBCO (maximum of 360mg/l measured in SBC_AUK_BH107).

The next highest concentrations were mainly located hydraulically down gradient of the maximum concentrations identified above, within the Made Ground or upper Tidal Flat Deposits. This suggests a groundwater plume originating from a localised source. Further higher concentrations were measured in the north of SBB, in the area of the HFO tanks (maximum 150mg/l in this area in BH-2006).

Although lower ammoniacal nitrogen concentrations are widespread across the site, the higher concentrations measured may correlate with historical site usage, indicating potential localised sources.

4.2.3.4 Surface Water

Surface water samples from the River Tees were obtained and reported in Royal Haskoning 2021. Samples were taken from locations during two rounds of monitoring.

Measured concentrations of TPH, phenolics VOC and SVOC were below the laboratory MDL. Concentrations of metals and inorganics were measured above the MDL, along with a number of PAH compounds. Measured concentrations were similar for the majority of CoC from all three sampling locations, suggesting no trends related to groundwater discharges from the site.

4.2.4 Summary of Contaminant Distribution Findings

In unsaturated soil, in most cases, no significant spatial distribution trends have been identified, suggesting Made Ground is of a similar composition across the site and should be considered as a single source. As such, contaminants measured in Made Ground are not generally due to primary contaminant sources associated with infrastructure and historical industrial processes on-site.

The highest hydrocarbon concentrations in soil were measured from around the SBCO area, including the highest measured concentration in downgradient monitoring well SBC_AUK_BH110. However, the highest concentrations in soils in this area were saturated, suggesting that they relate to a groundwater source rather than the Made Ground.

In groundwater, a more distinct plume is evident in the vicinity of the SBCO area and southern SBA boundary, in the same area as the highest saturated soil impacts. The highest groundwater contaminant concentrations were measured in SBA_AUK_BH110 adjacent to the southern boundary of SBA, which separates SBA from the SBCO facility (predominantly hydrocarbons and phenolics, and also cyanide). Relatively high hydrocarbon concentrations, particularly benzene, were measured in nearby locations around the SBCO area. SBA_AUK_ BH110 also had a measured thickness of DNAPL on two of the three groundwater monitoring visits undertaken in October and November 2020 resting at the base of the Slag Made Ground above the Tidal Flat Deposits.

Given that the Made Ground source material is in part saturated, the ground is uncovered, the permeable nature of the Made Ground, and the significant length of time the Made Ground has been present, partitioning into groundwater is likely to have occurred already. Based on this, groundwater is considered to provide the best representation of the potential risk to water resource receptors.

The seventeen sentinel wells along the northern boundary of the site generally screen the upper portion of the Tidal Flat Deposits, comprising sand, or screen the Made Ground. Based on the review of contaminant distribution and depth profile, they provide an indication of contaminant flow off-site towards the River Tees. Measured concentrations within the sentinel monitoring wells, and the contaminants present, are in line with those from across the remainder of the site. This is with the exception of groundwater in the area of SBA_AUK_ BH110 associated with the Groundwater Source, where contaminants (including hydrocarbons, PAH, phenolics, and also cyanide) are of higher concentration.

4.2.5 Modelled Source Area (including

Based on the above assessment of contaminant distribution, the conceptual understanding of site sources remains the same as the SBA DQRA; that the site can be conceptualised as comprising two sources to assess:

- **Made Ground Source** from across the site – considered to comprise a single diffuse soil source associated with Made Ground and slag.
- **Groundwater Source** in the vicinity of SBA_AUK_BH110 – considered to represent impacts associated with the SBCO area.

The Groundwater Source was modelled in the SBA DQRA (Arcadis, 2021d), which concluded that measured concentrations of CoC from the modelled Groundwater Source do not represent a significant risk to the primary water resource receptor (River Tees). As no changes have been made to the conceptual understanding of this area, and no additional groundwater monitoring has been undertaken, the findings of the

SBA DQRA are considered to remain valid. As such, only the Made Ground source has been assessed in this DQRA.

Made Ground is present across the site, including in the sentinel boreholes, and it is likely present immediately adjacent to the River Tees (albeit that a future sheet pile wall may be present in future, potentially reducing the flow of groundwater). The Made Ground source has therefore been conceptualised as the entirety of the site, immediately bordering the River Tees.

The modelled source length has selected in order to account for background contributions from the wider Teesworks site. This is on the understanding that Made Ground is likely present across a significant portion of the wide Teesworks site, particularly in areas bordering the River Tees where land reclamation will have occurred.

The modelled source length selected of 5km may allow the criteria developed in this assessment to be used to assess other areas of the Teesworks site where Made Ground is a single source. However, first a detailed conceptual review of any areas assessed in future needs to be undertaken. In particular, confirming sources, pathways and receptors remain applicable.

4.2.6 Selected Compounds for Modelling

The assessment has been undertaken based on contaminants measured above the laboratory MDL from 47 wells sampled to date from across the site. These are broadly in line with the CoC measured in the sentinel wells alone. Table 1 presents the CoC measured above the MDL and provides a screening exercise including a review of prevalence and availability of EQS to select CoC to model.

4.3 Water Resource Receptors

The primary water resource receptor associated with the site is considered to be The River Tees.

Surface water features present are the River Tees and the Teesmouth and Cleveland Estuary. Both are considered to be receptors, with the Teesmouth and Cleveland also being a designated Ramsar site, SPA and a SSSI.

Groundwater within the Tidal Flat Deposits and the Mercia Mudstone are designated as a Secondary A and Secondary B Aquifers, respectively. The remaining units identified are classified as unproductive strata. Groundwater was not assessed as a receptor at significant risk based the industrial history of the site and its surroundings, the brackish nature of the groundwater due to proximity to the estuary and the low potential for groundwater abstraction for potable water in the future. The resource potential for the underlying aquifers is therefore considered to be very low. Furthermore, assessment of the contaminant distribution indicates that the majority of contamination is restricted to the Made Ground and upper granular regions of the Tidal Flat Deposits. Contamination in the deeper underlying Tidal Flat Deposits and Mudstone are limited and localised, indicating that vertical migration into these units is limited.

4.4 Pathways

4.4.1 Modelled Pathways

To assess the potential risk presented to the identified receptors, the pathways defined as potentially active within the pollutant linkages need to be considered further. Site-specific information is used where possible to assign parameter values for:

- the physical characterisation of the geological and hydrogeological setting of the site.

Based on the results of the environmental investigations completed at the site, the CSM is presented on Figure 4.

The permeability of the Made Ground is likely much higher than that for the underlying natural geology, based on the soil log descriptions from the site. Evidence from tidal loggers also showed limited variation for groundwater depth (maximum 4cm) within the natural deposits, including locations tested within the vicinity of the River Tees. The absence of significant tidal variation in combination with the absence of a physical barrier (such as a sheet pile wall) between the River Tees suggests that the potential for lateral migration within these units is likely also limited. As such, Made Ground has been modelled as the primary unit from which the discharge of contamination into the River Tees occurs.

As discussed above in Section 4.2, Made Ground is present across the site, including in the sentinel boreholes, and it is likely present immediately adjacent to the River Tees. Therefore, a lateral migration pathway along which contaminant attenuation may occur has not been modelled.

Furthermore, given the diffuse nature of contamination in the Made Ground, absence of significant spatial distribution trends, the relatively permeable nature of the Made Ground, absence of hardstanding and the significant length of time the Made Ground has been present, concentrations immediately adjacent to the River Tees (and therefore potentially entering the River Tees, as represented by the sentinel wells), are likely to be at steady state in relation to the Made Ground source.

A sensitivity analysis has been carried out in line with the methodology outlined in the Remedial Targets Methodology (RTM) Guidance (EA, 2006), to assist with selection of parameter values required for the key fate and transport pathways. The results of sensitivity testing are presented in Appendix B. Sensitivity testing was completed for benzene. A full listing of the physical parameter values, used in the risk assessment is presented in Appendix C.

4.4.2 Environmental Fate and Transport Pathways

The environmental fate and transport pathway modelled within the DQRA is:

- Dilution with the receptor.

5 Detailed Quantitative Risk Assessment

5.1 Selection of the Assessment Tools

The DQRA has been undertaken using site-specific information, where available, to derive risk-based assessment criteria, which can be used to assess whether the measured concentrations of CoC on site present potentially unacceptable risks to the identified receptors.

A dilution assessment has been undertaken in line with the RTM guidance.

5.2 Methodology

The water resources risk assessment has been undertaken to assess the risk to the River Tees following the risk assessment methodology outlined in Appendix D.

The assessment has been undertaken in two stages, with the second stage undertaken dependent on the outcome of Stage 1:

1. Measured concentrations of contaminants in groundwater representing those with potential to enter the River Tees were directly compared with saline EQS.
2. Further to this, SSAC were calculated taking into account a dilution factor within the River Tees.

Measured concentrations of contaminants selected following contaminant screening (as discussed in Section 4.2.6) from the 67 groundwater monitoring wells sampled from 52 locations from across the site were compared to the assessment criteria as an initial assessment. Seventeen monitoring wells were installed along the northern boundary of the site, prior to the River Tees. These were described in the DQRA as “sentinel wells” and are considered to provide the best representation of groundwater potentially entering the River Tees due to their location at the northern of the site - in particular those screening Made Ground and upper granular portions of the Tidal Flat Deposits. As such, the groundwater quality data specifically from the sentinel wells were used to further discuss the potential risk presented to the receptor (River Tees), based on the findings of the initial assessment.

An assessment of contaminant travels times and time to steady state was undertaken in the SBA DQRA (Arcadis, 2021d) in relation to the Groundwater Source. This concluded that, whilst the timeframe assessment for the groundwater source indicated that steady state may not yet have been reached, any increase in concentrations at the sentinel wells was unlikely to cause the SSAC (considering dilution in the River Tees) to be exceeded.

In relation to the Made Ground Source, the SBA DQRA concluded: “*Given the diffuse nature of contamination in the Made Ground from across the site, the relatively permeable nature of the Made Ground and the significant length of time the Made Ground has been present, concentrations in sentinel wells are considered unlikely to increase further over time and to be at steady state in relation to Made Ground*.”

Following the review of the sources, this conclusion is considered to remain valid and supports the use of the sentinel wells to further evaluate the risk to the River Tees from the site.

5.3 Model Run Parameter

The model run parameters are presented in the table overleaf:

Parameter	Value	Comment
Compliance Point	Two compliance points were assessed given that Made Ground is present up to the boundary of the site: • Immediately prior to the River Tees (sentinel wells) • Within the River Tees (dilution in the receptor)	In line with RTM methodology
Compliance Criteria	CoC Specific – saline EQS adopted where available	Table 1

5.4 Stage 1 – Comparison with EQS

Comparison with the saline EQS has been undertaken for measured concentrations from the 67 groundwater monitoring wells sampled. These findings were reported in detail in the GQRAs (Arcadis, 2021a, 2021b, 2021c and Royal Haskoning 2021), and have been presented in Table 3 of this report for completeness. To summarise; multiple CoC including metals and inorganics, hydrocarbons and organic compounds exceeded the EQS.

Further assessment of the potential risk to the River Tees has been undertaken by comparison of measured concentrations of CoC from the 17 sentinel wells only (as presented in Table 3), representing contaminants with potential to enter the river.

Multiple CoC from the 17 sentinel well also exceeded the EQS, including:

- Metals (lead, nickel and zinc from multiple locations, plus cadmium, copper and chromium from a single location)
- Inorganics (including ammoniacal nitrogen and cyanide)
- Hydrocarbons (including PAH, TPH and BTEX)

Based on the above, dilution in the receiving surface water body (River Tees) is considered further below (Stage 2).

5.5 Stage 2 - Assessment Incorporating Dilution in the River Tees

5.5.1 Calculation of Potential Dilution Effects

The potential dilution occurring within surface water is calculated by considering both the flow rate of groundwater into surface water and the flow rate of the surface water. Surface water rates have been based on data provided by the Centre for Hydrology and Ecology National River Flow Archive (www.nrfa.ceh.ac.uk), for the River Tees (recorded at Leven Bridge, reference: 25005 and at Low Moor, reference 25009) and are presented in the table below. The 95th percentile (minimum monthly flow) has been adopted to undertake the dilution calculation:

River Tees (Leven Bridge & Low Moor)	Flow rate (m^3/s)	Flow Rate (m^3/day)
Mean flow	22.389	1,934,410
Minimum monthly flow	3.329	287,626

The rate of groundwater flow into the river is estimated using the following algorithm, based on Darcy's Law:

$$Q_{gw} = k \cdot i \cdot A$$

Where:

Q_{gw} = Groundwater rate of discharge into surface water (m^3/day)

k = Hydraulic conductivity (m/day)

i = Hydraulic gradient

A = Area of impacted groundwater entering river (m^2)

The values used for the above parameters are presented in Appendix C. In line with the methodology presented in the RTM, a sensitivity of parameters and justification of parameter ranges selected is discussed in Appendix B.

The dilution factor, DF, is calculated as:

$$DF_{River} = \frac{Qu + Qgw}{Qgw}$$

DF_{River} = Dilution factor within the river

Q_u = Surface water flow upstream of discharge point under low flow conditions (m^3/day) – minimum flow rate

Q_{gw} = Groundwater rate of discharge into surface water (m^3/day)

As such, using the input parameters in Appendix C, the dilution factor at the 95th percentile is calculated as:

DF_{River} = 2,997

5.5.2 Development of Water Resource SSAC

SSAC defined for the protection of the identified water resource receptors have been derived in line with the RTM. 10% of the EQS was multiplied by the dilution factor.

The SSAC derived have been compared to the theoretical solubility. Where the SSAC exceeds the theoretical solubility, this is indicated by ">SOL" in the SSAC columns in the tables, and these CoC are not considered to pose unacceptable risks to the identified water resources receptors.

The SSAC derived are presented in Table 2.

5.5.3 Dilution Assessment Outcome

A comparison of the measured concentrations of the CoC with the SSAC is presented in Table 3.

The table overleaf presents a summary of the findings of the comparison. Maximum measured concentrations from the 47 monitoring wells samples from across site which exceeds the SSAC calculated with dilution are presented. Locations indicated in *grey italics* are located in the SBCO area. Measured concentrations are potentially associated with the Groundwater source modelled in the SBA DQRA. Where more than one round of monitoring has been undertaken, lower concentrations may have been recorded which do not exceed the SSAC.

Compound	SSAC (µg/l)	Number of Locations Exceeding SSAC	Maximum Measured Concentration (µg/l) & Location of Exceedances
Aliphatic >C6-C8	1,360	1	1,400 (SBA_AUK_BH104)
Aromatic >EC10-EC12	1,360	3	*8,900 (SBA_AUK_BH110)* *4,200 (SBC_AUK_BH106)* *4,000 (SBC_AUK_BH107)*
Aromatic >EC12-EC16	1,360	4	*1,600 (SBA_AUK_BH105)* *1,600 (SBA_AUK_BH110)* *2,500 (SBC_AUK_BH106)* *2,100 (SBC_AUK_BH107)*
Benzene	2,400	1	*47,000 (SBA_AUK_BH110)*
Naphthalene	599	4	880 (SBA_AUK_BH103) *1900 (SBA_AUK_BH105)* *11,000 (SBA_AUK_BH110)* *6,000 (SBC_AUK_BH107)*
Fluoranthene	1.89	3	*260 (SBA_AUK_BH110)* 4.2 (SBB_AUK_BH104) *2.8 (SBC_AUK_BH107)*
Anthracene	30	1	*52 (SBA_AUK_BH110)*
Benzo(a)pyrene	0.0509	12	0.12 (BH-2013) 0.1 (BH-2014) 0.1 (SBA_AUK_BH103) 0.06 (SBA_AUK_BH106) *100 (SBA_AUK_BH110)* 2 (SBB_AUK_BH104) 0.08 (SBB_AUK_BH106) 0.11 (SBB_XXX_BH204A) 0.58 (SBC_AUK_BH101) 0.43 (SBC_AUK_BH102) *0.09 (SBC_AUK_BH106)* 0.11 (SBC_AUK_BH108)
Monohydric Phenols	2,310	1	*16,000 (SBA_AUK_BH110)*

Compound	SSAC (µg/l)	Number of Locations Exceeding SSAC	Maximum Measured Concentration (µg/l) & Location of Exceedances
Total Cyanide	300	6	*300 (SBA_AUK_BH105)* 350 (SBA_AUK_BH106) *690 (SBA_AUK_BH110)* 3,800 (SBB_AUK_BH106) *1,400 (SBC_AUK_BH107)* 420 (SBC_AUK_BH112)
Thiocyanate	2,700	15	5,500 (BH-2001) 17,000 (BH-2005) 60,000 (BH-2006) 22,000 (BH-2009) 100,000 (BH-2010) *62,000 (SBA_AUK_BH110)* 77,000 (SBB_AUK_BH101) 33,000 (SBB_AUK_BH102) 86,000 (SBB_AUK_BH103) 140,000 (SBB_AUK_BH104) 270,000 (SBB_AUK_BH105) 1,700,000 (SBB_AUK_BH106) 36,000 (SBB_AUK_BH108) *9,500 (SBC_AUK_BH107)* *4,400 (SBC_AUK_BH114)*
Ammoniacal Nitrogen as N	6,290	24	8,500 (BH-2001) 8,000 (BH-2004) 150,000 (BH-2006) 14,000 (BH-2009) 28,000 (BH-2010) 25,000 (BH-2024) 11,000 (BH-2025) 220,000 (SBA_AUK_BH103) *250,000 (SBA_AUK_BH105)* 14,000 (SBA_AUK_BH108) *31,000 (SBA_AUK_BH110)* 12,000 (SBB_AUK_BH101)

Compound	SSAC (µg/l)	Number of Locations Exceeding SSAC	Maximum Measured Concentration (µg/l) & Location of Exceedances
			8,700 (SBB_AUK_BH102) 88,000 (SBB_AUK_BH103) 7,000 (SBB_AUK_BH104) 18,000 (SBB_AUK_BH106) 22,000 (SBB_AUK_BH108) 7,500 (SBB_XXX_BH204A) 8,100 (SBC_AUK_BH103) *24,000 (SBC_AUK_BH106)* *360,000 (SBC_AUK_BH107)* 30,000 (SBC_AUK_BH113) *210,000 (SBC_AUK_BH114)* 8,200 (SBC_AUK_BH115)
Hexavalent Chromium	180	1	*280 (SBA_AUK_BH110)*

Further assessment of the potential risk to the River Tees has been undertaken by comparison of measured concentrations from the 17 sentinel wells only, representing potential concentrations entering the river.

Only ammoniacal nitrogen, thiocyanate and benzo(a)pyrene in groundwater exceed the SSAC in the **sentinel wells**. Measured concentrations of ammoniacal nitrogen, thiocyanate and benzo(a)pyrene exceed the SSAC with dilution in seven, five and two out of the 17 locations monitored respectively.

5.5.4 Further Evaluation of Ammoniacal Nitrogen, Thiocyanate and Benzo(a)Pyrene

Further evaluation of the potential level of risk presented to the River Tees from measured concentrations of ammoniacal nitrogen, thiocyanate and benzo(a)pyrene has been undertaken below based on their presence in sentinel wells.

The following general considerations are taken into account in the further evaluation below:

- The SSAC derived in this report relate to a 5,000m source length to account for background contributions from the wider Teesworks site. This was based on the likely presence of diffuse contamination across the Teesworks site associated with Made Ground. Measured concentrations of contaminants associated with other historical land uses are more localised and the use of the 5,000m source length is therefore highly conservative in these instances. On its own, the SB site length parallel with the River Tees is approximately 1,350m. Where a source is localised, comparing to the SSAC appropriate for the wider Teesworks site may over-estimate the level of risk present.
- The dilution factors used in this report for the derivation of SSAC are based on upstream gauging stations on the River Tees and do not fully account for flow contributions for the lower Tees and estuary catchment. By comparison of the catchment area data provided by Centre for Hydrology and Ecology and the Environment Agency, it is estimated that the gauging stations used account for approximately 75% of the Tees catchment area. Therefore, the flow at the Teesworks site is underestimated, making the SSAC conservative.

- The dilution factors used in this report use low flow river conditions in line with RTM guidance. Mean flow rates, which are approximately 6.7 times higher than low flow conditions, may be more representative of likely conditions.
- The dilution effect only considers freshwater flow from the River Tees. Tidal flow within the river at the Teesworks site is also active as the river is estuarine at this point. An estimate of the tidal flow has not been made at this point. However, it is considered likely to make a significantly larger contribution to dilution for conditions other than low tide. The tidal range at Tees Docks (located approximately 700m from SB) is typically around 5m.

5.5.4.1 Ammoniacal Nitrogen

The assessment of contaminant distribution indicates that, whilst lower concentrations of ammoniacal nitrogen are widespread across the site, the highest concentrations are more localised and appear to be associated with historical land uses. These include the SBCO and the HFO tanks. Ammoniacal nitrogen groundwater distribution is presented on Figures 3ac and 3ad for Made Ground and natural geology respectively.

As discussed above, the dilution assessment undertaken considers a 5,000m source length to account for background contributions from the wider Teesworks site. The distribution of ammoniacal nitrogen concentrations exceeding the SSAC with dilution relates to approximately 800m parallel with the River Tees.

Adjusting the modelled source length to 800m to account for the localised ammoniacal distribution increases the dilution factor from 2,997 to 18,727. Using this dilution factor, an SSAC for a localised ammoniacal nitrogen source would be 39,000µg/l. A single sentinel well had measured ammoniacal nitrogen concentrations above this criterion on one occasion (150,000µg/l on 16th February 2021). Concentrations measured during the subsequent monitoring visit on 9th March 2021 were below the SSAC (20,000µg/l).

As an additional line of evidence, the compliance criteria for ammoniacal nitrogen has also been reviewed. Ammoniacal nitrogen species may exist as either the ammonium ion (NH_4^+) or the more toxic free ammonia (NH_3). Under all normal conditions the bulk of the ammonia encountered in estuaries will be as the ammonium ion. In marine waters, particularly at higher salinities, it has been shown that the ammonium ion can also permeate fish gills. The habitats standards for estuaries (WQTAG086, 2005) provides an annual average value of 1,100µg/l for total ammoniacal nitrogen which accounts for the presence of the ammonium ion. An SSAC calculated using this value as the compliance criteria would not be exceeded (SSAC of 3,300,000µg/l for a 5,000m source length or 20,600,700µg/l for an 800m source length).

Based on the above, and considering the conservatisms highlighted in Section 5.5.4, measured ammoniacal nitrogen concentrations are considered unlikely to present a significant risk to the identified water resource receptor (River Tees).

5.5.4.2 Thiocyanate

Similarly to ammoniacal nitrogen, assessment of the thiocyanate contaminant distribution indicates that, whilst lower concentrations of thiocyanate are widespread across the site, the highest concentrations are more localised in the SBB area and may be associated with historical land uses. Thiocyanate groundwater distribution is presented on Figures 3ae and 3af for Made Ground and natural geology respectively.

The distribution of thiocyanate concentrations exceeding the SSAC with dilution relates to approximately 500m parallel with the River Tees.

Adjusting the modelled source length to 500m to account for the localised thiocyanate distribution increases the dilution factor from 2,997 to 29,970. Using this dilution factor, an SSAC for a localised thiocyanate source would be 27,000µg/l. Two sentinel wells had measured thiocyanate concentrations above this criterion (BH-2006 at 60,000µg/l & BH-2010 at 100,000µg/l). To date, samples from these two wells have only been analysed once for thiocyanate. In other monitoring wells from SBB, a large variation in thiocyanate

concentrations has been measured (greatest variation in SBB_AUK_BH101 ranging from 140µg/l to 77,000µg/l). This indicates that a variation may also be expected in the sentinel wells.

In addition to the further considerations in 5.5.4 above, it is noted that a statutory UK EQS for thiocyanate does not exist. The assessment has instead been based on a Predicted No Effects Concentration (PNEC). The absence of an EQS may indicate that a substance is less well characterised or of lower environmental concern. Assessment of the related cyanide species, for which an EQS is present, indicates that measured cyanide concentrations do not present a significant level of risk.

Although the distribution of free and total cyanide does not form such an apparent plume-like distribution in SBB as thiocyanate, the maximum measured free and total cyanide concentrations coincide with the maximum measured thiocyanate concentrations in SBB_AUK_BH106. This indicates a likely link between these related cyanide species and supports the indicator approach of using total and free cyanide to assess risk.

Based on the above, and considering the conservatisms highlighted in Section 5.5.4, measured thiocyanate concentrations are considered unlikely to present a significant risk to the identified water resource receptor (River Tees).

5.5.4.3 Benzo(a)pyrene

Benzo(a)pyrene marginally exceeded the SSAC in two sentinel wells (maximum 0.12µg/l vs. SSAC of 0.0509). These two wells (BH-2013 and BH-2014) have been sampled on three occasions. Measured benzo(a)pyrene concentrations on the other two monitoring visits were below the SSAC and also below laboratory MDL in most instances (single exception of BH-2013 on 8th March 2021, measured concentration of 0.05µg/l).

Based on the above, and considering the conservatisms highlighted in Section 5.5.4, measured benzo(a)pyrene concentrations are considered unlikely to present a significant risk to the identified water resource receptor (River Tees).

5.6 Water Resource Risk Evaluation

Multiple CoC including metals and inorganics, hydrocarbons and organic compounds exceeded the EQS in groundwater in both the sentinel wells and from the wider site. This represents a point of compliance immediately prior to the River Tees.

Dilution in the receiving surface water body (River Tees) has been further considered by the calculation of SSAC. This assessment indicates that a limited number of CoC, sampled from the 67 wells from across the site, exceed the SSAC derived including hydrocarbons (TPH and PAH), phenols, cyanide, thiocyanate, ammoniacal nitrogen and hexavalent chromium. Monitoring well locations where concentrations exceed the SSAC with dilution include:

- BH-2001
- BH-2004
- BH-2005
- BH-2006
- BH-2009
- BH-2010
- BH-2013
- BH-2014
- BH-2024
- BH-2025

- SBA_AUK_BH103
- SBA_AUK_BH104
- SBA_AUK_BH105
- SBA_AUK_BH106
- SBA_AUK_BH108
  SBA_AUK_BH110
- SBB_AUK_BH101
- SBB_AUK_BH102
- SBB_AUK_BH103
- SBB_AUK_BH104
- SBB_AUK_BH105
- SBB_AUK_BH106
- SBB_AUK_BH108
- SBB_XXX_BH204A
- SBC_AUK_BH101
- SBC_AUK_BH102
- SBC_AUK_BH104
- SBC_AUK_BH106
- SBC_AUK_BH107
- SBC_AUK_BH112
- SBC_AUK_BH113
- SBC_AUK_BH114
- SBC_AUK_BH115

Several of the site wide wells where the SSAC were exceeded are in the area of the SBCO, this includes SBA_AUK_BH105, SBA_AUK_BH110, SBC_AUK_BH106, SBC_AUK_BH107, SBC_AUK_BH112 and SBC_AUK_BH114. SBA_AUK_BH105 and SBA_AUK_BH110 were included in the modelled groundwater source area. SBC_AUK_BH107 and SBC_AUK_BH114 are located south of SBA_AUK_BH105 and SBA_AUK_BH110 in relatively close proximity (approximately 70m). SBC_AUK_BH106 is to the east of SBCO.

Review of the distribution indicates that the CoC exceeding the SSAC in the five wells identified above are likely associated with a localised source around SBCO, rather than the Made Ground across the site. The majority of the CoC in this area were assessed in the SBA DQRA which concluded that a significant risk to water resources was not present based on the attenuation occurring during lateral migration and subsequent dilution in the River Tees. SBA_AUK_BH103 and SBC_AUK_BH113 are also potentially down gradient of this area and maybe associated with the plume.

Monitoring wells SBA_AUK_BH106, SBA_AUK_BH104, SBA_AUK_BH108, SBC_AUK_BH101 and SBC_AUK_BH102, screen lower permeability natural geology and are spread across the site with a single CoC exceeding at each location. These locations are between 400m and 1,200m from the River Tees. The influence of concentrations associated with these wells on down gradient groundwater quality and the River Tees is considered to be limited.

Where measured concentrations of CoC exceed the SSAC, notably higher concentrations have sometimes been measured on one of multiple monitoring visits. This is the case in SBA (three rounds of monitoring undertaken) for several of the wells where TPH or PAH concentrations exceed and may indicate entrainment of fines on some monitoring visits. Of note is SBA_AUK_BH103 (shallow installation) where naphthalene concentrations ranged from 5.2µg/l to 880µg/l and SBA_AUK_BH104 where aliphatic C6-C8 concentrations ranged from <0.1µg/l to 1,400µg/l.

Other than the monitoring well locations discussed above, the remaining 18 locations exceeding the SSAC (including 10 sentinel wells) are locations where ammoniacal nitrogen, thiocyanate or benzo(a)pyrene also exceed. A limited number of additional CoC also exceeded SSAC in four of these wells, with wells generally screening deeper less permeable strata and no evidence of lateral migration into down gradient locations. The closest of these locations (SBB_AUK_BH108) is 300m from the River Tees.

Ammoniacal nitrogen exceeds the SSAC in several wells from across the site, including in a number of the sentinel wells: BH-2001, BH-2004, BH-2006, BH-2009, BH-2010, BH-2024 and BH-2025. The SSAC for ammoniacal nitrogen has been reviewed based on the width of the site where wells have measured ammoniacal nitrogen concentrations above the SSAC. The revised assessment criteria indicated that measured concentrations of ammoniacal nitrogen do not present a risk to the River Tees.

Thiocyanate exceeds the SSAC in several wells from across the site, including in a number of the sentinel wells: BH-2001, BH-2005, BH-2006, BH-2009 and BH-2010. Further assessment of the potential risk to the River Tees was undertaken. This look at multiple lines of evidence, including the revision of SSAC based on a more localised thiocyanate source and concluded that measured thiocyanate concentrations are considered unlikely to present a significant risk to the identified water resource receptor (River Tees).

Benzo(a)pyrene exceeds the SSAC in several wells from across the site, including in two of the sentinel wells: BH-2013 and BH2014. Further assessment of the three rounds of monitoring undertaken indicated that concentrations were generally below the SSAC and only marginally above on a single occasion.

Review of the site wide exceedances of the SSAC above indicates that assessment using the 17 sentinel wells is appropriate to further assess the potential risk to the River Tees. Based on the SSAC derived, none of the measured concentrations from the sentinel wells exceed the SSAC (with the exception of benzo(a)pyrene in two wells on a single occasion, thiocyanate and ammoniacal nitrogen). A number of conservative assumptions were identified in Section 5.5.4 which were used to consider the potential risk further. The further assessment highlighted that benzo(a)pyrene, thiocyanate and ammoniacal nitrogen are unlikely to present a significant risk to the identified water resource receptor (River Tees). As such, the risk to water resource receptors (River Tees) is not considered significant.

5.6.1 Other Considerations

Non-aqueous Phase Liquid has been measured on site. This may require consideration as part of remediation works however, dissolved phase concentrations indicate that NAPL is not presenting a risk to water resources.

A potential pathway due to piled foundations was identified under the pollutant linkages. Based on the findings of the contaminant distribution and underlying ground conditions, it is considered unlikely that this pathway could represent a significant risk to water resources. Although contamination may locally be able to enter the underlying natural deposits around piles, lateral migration within the unit is unlikely to be significant.

5.7 Assumption, Limitation and Data Gaps

The SSAC defined to offer protection to the identified water resource receptors are based on current best practice and are defined using the site investigation data available at the present time. Modifications to the conceptual model, such as the collection of additional site data, may result in changes to the SSAC defined here.

6 Conclusions

A DQRA has been completed for the site, based on the available investigation and monitoring data and focused on potential risks to water resource receptors.

Based on the findings of the previous SBA DQRA (Arcadis, 2021d) and the review of the CSM undertaken in this DQRA, the **Groundwater Source** in the area of SBA_AUK_BH110 (interpreted to be associated with the SBCO), is not considered to present a significant risk to the identified water resource receptor (River Tees).

The findings of the water resource assessment for the **Made Ground Source** undertaken in this DQRA concludes that the site does not present a significant risk to the River Tees.

This assessment supersedes the assessment of the Made Ground Source undertaken in the first issue of the SBA DQRA (Arcadis, 2021d) which also concluded that the Made Ground (SBA) does not present a significant level of risk to the River Tees.

The criteria developed in this assessment may potentially be used to assess other areas of the Teesworks site where Made Ground is a single source. However, first a detailed conceptual review of any areas assessed in future needs to be undertaken. In particular, confirming sources, pathways and receptors remain applicable.

6.1.1 Other Considerations

Non-aqueous Phase Liquid has been measured on site. This may require consideration as part of remediation works however, dissolved phase concentrations indicate that NAPL is not presenting a risk to water resources.

A potential pathway due to piled foundations was identified under the pollutant linkages. Based on the findings of the contaminant distribution and underlying ground conditions, it is considered unlikely that this pathway could represent a significant risk to water resources. Although contamination may locally be able to enter the underlying natural deposits around piles, lateral migration within the unit is unlikely to be significant.

It is recommended that risks to human health are also considered at the design stage of any proposed redevelopment based on the findings of the GQRA with regards to dermal, ingestion and inhalation pathways.

7 References

Department for Environment, Food and Rural Affairs (DEFRA), 2012. Contaminated Land Statutory Guidance, which came into force on 6th April 2012.

Department of the Environment (DoE), 1989. Water Supply (Water Quality) Regulations. England and Wales. HMSO.

Department of Environment, Transport and Regions (DETR), 2000. Water Supply (Water Quality) Regulations. England and Wales. HMSO.

Environment Agency, 2006. Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination.

Environment Agency, 2017. Groundwater Protection – Land contamination groundwater compliance points: quantitative risk assessment, March 2017.

Environment Agency (EA), 2020. Land Contamination Risk Management (LCRM). Last updated 19th April 2021).

Habitats Directive Technical Advisory Group on Water Quality (2005). Ammonia standards in estuaries, WQTAG086. Revised: 20th April 2005.

Figures

LEGEND

- SITE BOUNDARY
- HANSON LEASEHOLD
- SBA
- SBB
- SBC
- SBCO

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

0 35 70 140 210 280 350 Metres

N

TITLE: **SITE LOCATION AND ENVIRONMENTAL SETTING**

SITE : **REDCAR SOUTH BANK**

CLIENT : **STDC**

PROJECT :	**10035117**	**FIGURE 1**	
DATE :	23/07/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0012-P1		
SCALE :	**1 : 9,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

SITE BOUNDARY

MONITORING WELL LOCATION

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

0 25 50 100 150 200 250 Metres

N

TITLE:

MONITORING WELL LOCATION PLAN

SITE :

REDCAR SOUTH BANK

CLIENT :

SOUTH TEES DEVELOPMENT CORPORATION

PROJECT :	**10035117**	**FIGURE 2**	
DATE :	23/07/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0373-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- <MDL
- <MDL - 10mg/kg
- 10 - 100mg/kg
- 100 - 1,000mg/kg
- 1,000 - 10,000mg/kg
- SITE BOUNDARY

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6.

N

0 20 40 80 120 160 200 Metres

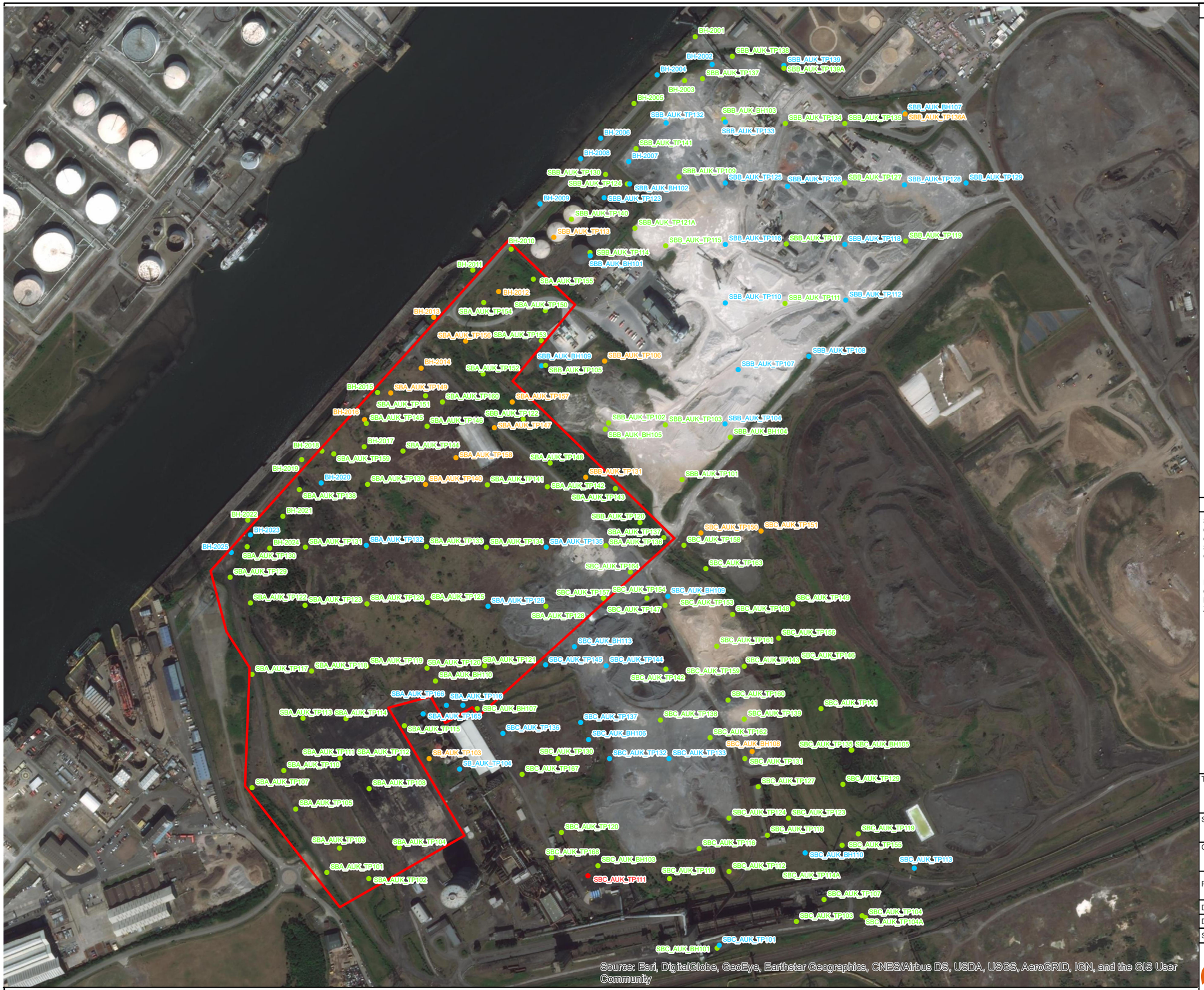
TITLE: **MEASURED TOTAL PETROLEUM HYDROCARBON CONCENTRATIONS IN SOIL (mg/kg)**

SITE : **REDCAR SOUTH BANK AREA A**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	10035117	FIGURE 3a	
DATE :	27/08/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0374-P1 GIS		
SCALE :	1 : 6,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets



LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 10mg/kg
- 10 - 100mg/kg
- 100 - 1,000mg/kg
- 1,000 - 10,000mg/kg

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6.

N

0 20 40 80 120 160 200 Metres

TITLE: **MEASURED COPPER CONCENTRATIONS IN SOIL (mg/kg)**

SITE : **REDCAR SOUTH BANK AREA A**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	10035117	FIGURE 3b	
DATE :	27/08/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0375-P1 GIS		
SCALE :	1 : 6,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- <MDL
- MDL - 10mg/kg
- 10 - 100mg/kg
- 100 - 1,000mg/kg
- 1,000 - 10,000mg/kg
- SITE BOUNDARY

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6

0 20 40 80 120 160 200 Metres

N

TITLE: **MEASURED LEAD CONCENTRATIONS IN SOIL (mg/kg)**

SITE : **REDCAR SOUTH BANK AREA A**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	10035117	FIGURE 3c	
DATE :	30/08/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0376-P1 GIS		
SCALE :	1 : 6,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 10mg/kg
- 10- 100mg/kg
- 100 - 500mg/kg

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6

N

0 20 40 80 120 160 200 Metres

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

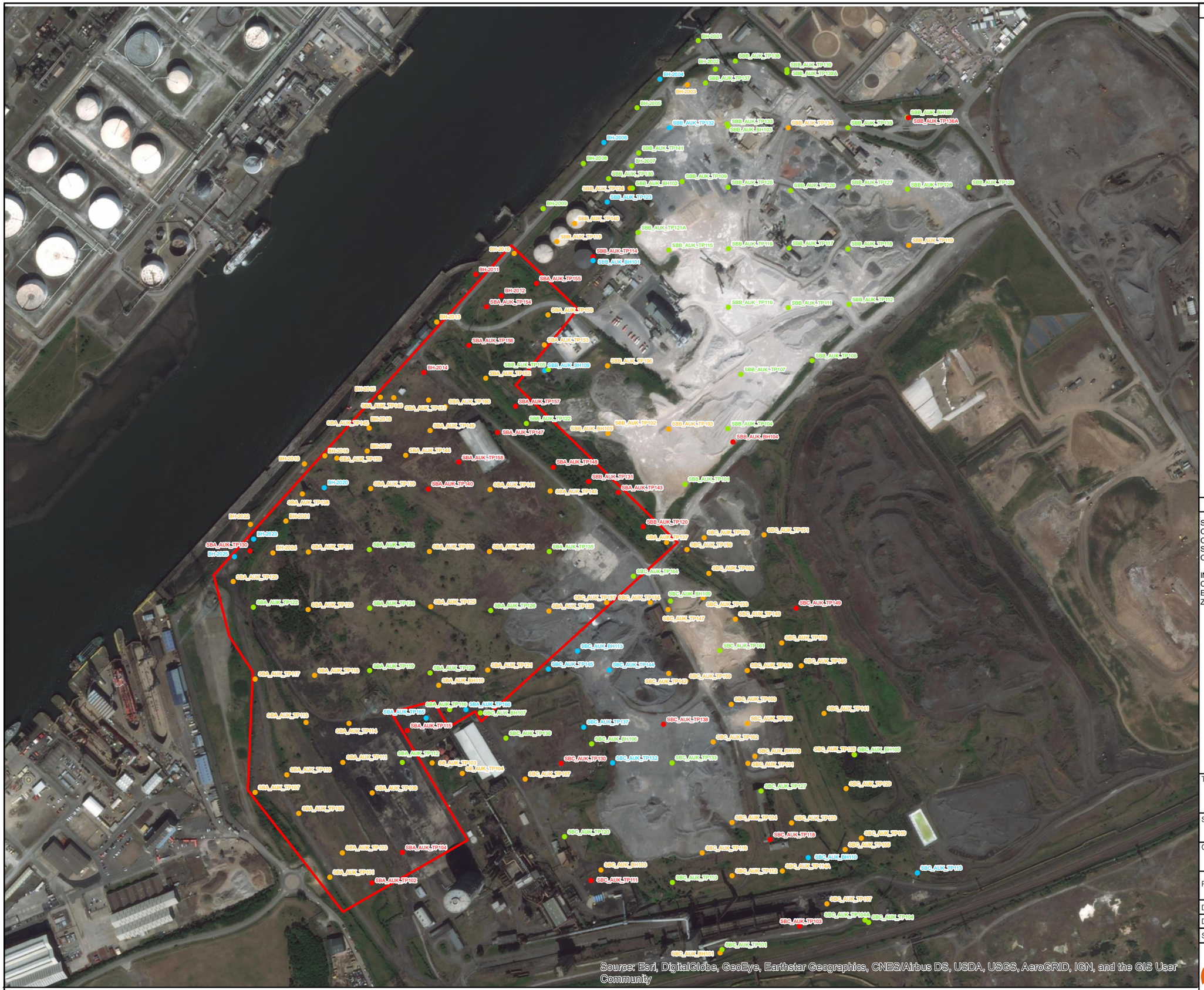
TITLE:
MEASURED NICKEL CONCENTRATIONS IN SOIL (mg/kg)

SITE :
REDCAR SOUTH BANK AREA A

CLIENT :
SOUTH TEES DEVELOPMENT CORPORATION

PROJECT :	**10035117**	**FIGURE 3d**	
DATE :	02/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0377-P1 GIS		
SCALE :	**1 : 6,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets



LEGEND

- <MDL
- <MDL - 10mg/kg
- 10 - 100mg/kg
- 100 - 1,000mg/kg
- 1,000 - 10,000mg/kg
- SITE BOUNDARY

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6

N

0 20 40 80 120 160 200 Metres

TITLE:
MEASURED ZINC CONCENTRATIONS IN SOIL (mg/kg)

SITE :
REDCAR SOUTH BANK AREA A

CLIENT :
SOUTH TEES DEVELOPMENT CORPORATION

PROJECT :	10035117	FIGURE 3e	
DATE :	09/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0378-P1 GIS		
SCALE :	1 : 6,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 10mg/kg
- 10 - 100mg/kg
- 100 - 1,000mg/kg

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6

N

0 20 40 80 120 160 200 Metres

TITLE:
MEASURED TOTAL CYANIDE CONCENTRATIONS IN SOIL (mg/kg)

SITE :
REDCAR SOUTH BANK AREA A

CLIENT :
SOUTH TEES DEVELOPMENT CORPORATION

PROJECT :	10035117	FIGURE 3f	
DATE :	03/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0379-P1 GIS		
SCALE :	1 : 6,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5mg/kg
- 0.5 - 1mg/kg
- 1 - 5mg/kg
- 5 - 10mg/kg
- >10mg/kg

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6

N

0 20 40 80 120 160 200 Metres

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

TITLE:
MEASURED FREE CYANIDE CONCENTRATIONS IN SOIL (mg/kg)

SITE :
REDCAR SOUTH BANK AREA A

CLIENT :
SOUTH TEES DEVELOPMENT CORPORATION

PROJECT :	**10035117**	**FIGURE 3g**	
DATE :	09/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0017-P1 GIS		
SCALE :	**1 : 6,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5mg/kg
- 0.5 - 1mg/kg
- 1 - 5mg/kg
- 5 - 10mg/kg
- >10mg/kg

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6

N

0 20 40 80 120 160 200 Metres

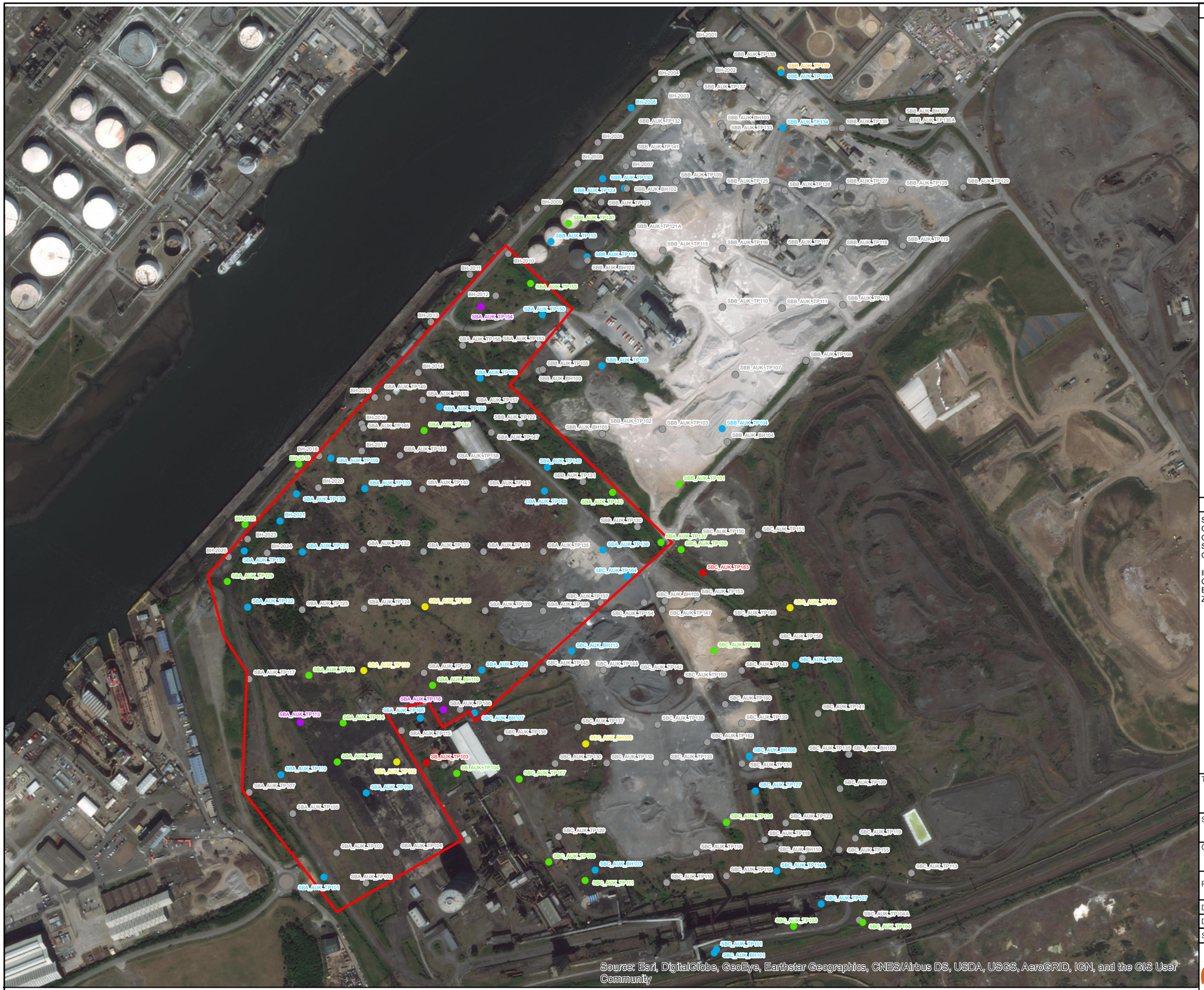
TITLE:
MEASURED BENZENE CONCENTRATIONS IN SOIL (mg/kg)

SITE :
REDCAR SOUTH BANK AREA A

CLIENT :
SOUTH TEES DEVELOPMENT CORPORATION

PROJECT :	10035117	FIGURE 3h	
DATE :	09/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0381-P1 GIS		
SCALE :	1 : 6,137	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets



LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.1mg/kg
- 0.1 - 1.0mg/kg
- 1.0 - 10mg/kg
- 10 - 100mg/kg
- 100 - 1,000mg/kg
- >1,000mg/kg

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6

N

0 20 40 80 120 160 200 Metres

TITLE:
MEASURED NAPHTHALENE CONCENTRATIONS IN SOIL (mg/kg)

SITE :
REDCAR SOUTH BANK AREA A

CLIENT :
SOUTH TEES DEVELOPMENT CORPORATION

PROJECT :	**10035117**	**FIGURE 3i**	
DATE :	09/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0382-P1 GIS		
SCALE :	**1 : 6,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 1.0mg/kg
- 1.0 - 10mg/kg
- 10 - 100mg/kg

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

INCLUDES THE MAXIMUM MEASURED CONCENTRATION IN UNSATURATED SOIL FROM EACH LOCATION, WHERE THE UNSATURATED ZONE IS DEFINED AS THE TOP 6

N

0 20 40 80 120 160 200 Metres

TITLE:
MEASURED AMMONIACAL NITROGEN CONCENTRATIONS IN SOILL (mg/kg)

SITE :
REDCAR SOUTH BANK AREA A

CLIENT :
SOUTH TEES DEVELOPMENT CORPORATION

PROJECT :	**10035117**	**FIGURE 3j**	
DATE :	03/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0383-P1 GIS		
SCALE :	**1 : 6,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- <MDL - 10µg/l
- 10 - 100µg/l
- 100 - 1,000µg/l
- 1,000 - 10,000µg/l
- >10,000µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED TOTAL PETROLEUM HYDROCARBON CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3k**	
DATE :	03/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0384-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- <MDL - 10µg/l
- 10 - 100µg/l
- 100 - 1,000µg/l
- 1,000 - 10,000µg/l
- >10,000µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED TOTAL PETROLEUM HYDROCARBON CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3I**	
DATE :	03/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0385-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- <MDL
- MDL - 0.5µg/l
- 0.5 - 1µg/l
- 1 - 5µg/l
- 5 - 10µg/l
- >10µg/l
- SITE BOUNDARY

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED COPPER CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3m**	
DATE :	03/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0386-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5µg/l
- 0.5 - 1µg/l
- 1 - 5µg/l
- 5 - 10µg/l
- >10µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED COPPER CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	10035117	FIGURE 3n	
DATE :	06/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-03587-P1 GIS		
SCALE :	1 : 7,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5µg/l
- 0.5 - 1µg/l
- 1 - 5µg/l
- 5 - 10µg/l
- >10µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED LEAD CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3o**	
DATE :	06/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0388-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- <MDL
- MDL - 0.5µg/l
- 0.5 - 1µg/l
- 1 - 5µg/l
- 5 - 10µg/l
- >10µg/l
- SITE BOUNDARY

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED LEAD CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3p**	
DATE :	06/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-00389-P1 GIS		
SCALE :	**1 : 6,910**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5µg/l
- 0.5 - 1µg/l
- 1 - 5µg/l
- 5 - 10µg/l
- >10µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED NICKEL CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3q**	
DATE :	06/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0390-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5µg/l
- 0.5 - 1µg/l
- 1 - 5µg/l
- 5 - 10µg/l
- >10µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED NICKEL CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	10035117	FIGURE 3r	
DATE :	06/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0391-P1 GIS		
SCALE :	1 : 7,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5µg/l
- 0.5 - 1µg/l
- 1 - 5µg/l
- 5 - 10µg/l
- >10µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED ZINC CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3s**	
DATE :	06/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0392-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5µg/l
- 0.5 - 1µg/l
- 1 - 5µg/l
- 5 - 10µg/l
- >10µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED ZINC CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3t**	
DATE :	06/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0393-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- MDL
- MDL - 10ug/l
- 10 - 100ug/l
- 100 -500ug/l
- 500 - 1,000ug/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED TOTAL CYANIDE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	10035117	FIGURE 3u	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0394-P1 GIS		
SCALE :	1 : 7,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- MDL
- MDL - 10ug/l
- 10 - 100ug/l
- 100 -500ug/l
- 500 - 1,000ug/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED TOTAL CYANIDE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	10035117	FIGURE 3v	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0395-P1 GIS		
SCALE :	1 : 7,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5ug/l
- 0.5 - 1ug/l
- 1 - 5ug/l
- 5 - 10ug/l
- >10ug/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED FREE CYANIDE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3w**	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0396-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 0.5mg/kg
- 0.5 - 1mg/kg
- 1 - 5mg/kg
- 5 - 10mg/kg
- >10

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

0 25 50 100 150 200 250 Metres

N

TITLE: **MEASURED FREE CYANIDE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	10035117	FIGURE 3x	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0397-P1 GIS		
SCALE :	1 : 7,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- <MDL - 10 mg/kg
- 10 - 100 mg/kg
- 100 - 1,000 mg/kg
- 1,000 - 10,000
- >10,000

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE:
MEASURED BENZENE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)

SITE :
REDCAR SOUTH BANK

CLIENT :
SOUTH TEES DEVELOPMENT CORPORATION

PROJECT :	**10035117**	**FIGURE 3y**	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0398-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- <MDL - 10 mg/kg
- 10 - 100 mg/kg
- 100 - 1,000 mg/kg
- 1,000 - 10,000
- >10,000

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

0 25 50 100 150 200 250 Metres

N

TITLE: **MEASURED BENZENE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	10035117	FIGURE 3z	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0399-P1 GIS		
SCALE :	1 : 7,000	PRINT :	A3

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- <MDL - 10 mg/kg
- 10 - 100 mg/kg
- 100 - 1,000 mg/kg
- 1,000 - 10,000
- >10,000

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED NAPHTHALENE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3aa**	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0400-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- <MDL - 10µg/l
- 10 - 100µg/l
- 100 - 1,000µg/l
- 1,000 - 10,000µg/l
- >10,000µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED NAPHTHALENE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3ab**	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0401-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- < MDL
- MDL - 1mg/l
- 1 - 5mg/l
- 5 - 10mg/l
- 10 - 100mg/l
- >100mg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

0 25 50 100 150 200 250 Metres

N

TITLE: **MEASURED AMMONIACAL NITROGEN AS N CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND(mg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3ac**	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0402-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LEGEND

- SITE BOUNDARY
- < MDL
- MDL - 1mg/l
- 1 - 5mg/l
- 5 - 10mg/l
- 10 - 100mg/l
- >100mg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

0 25 50 100 150 200 250 Metres

N

TITLE: **MEASURED AMMONIACAL NITROGEN AS N CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA(mg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3ad**	
DATE :	07/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0403-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 100µg/l
- 100 - 1,000µg/l
- 1,000 - 10,000µg/l
- 10,000 - 100,000µg/l
- >100,000µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED THIOCYANATE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING MADE GROUND (µg/l)**

SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

PROJECT :	**10035117**	**FIGURE 3ae**	
DATE :	10/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0404-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

LEGEND

- SITE BOUNDARY
- <MDL
- MDL - 100µg/l
- 100 - 1,000µg/l
- 1,000 - 10,000µg/l
- 10,000 - 100,000µg/l
- >100,000µg/l

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

N

0 25 50 100 150 200 250 Metres

TITLE: **MEASURED THIOCYANATE CONCENTRATIONS IN GROUNDWATER: WELLS SCREENING NATURAL STRATA (µg/l)**

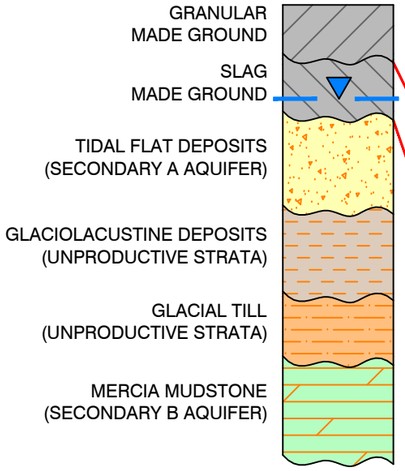
SITE : **REDCAR SOUTH BANK**

CLIENT : **SOUTH TEES DEVELOPMENT CORPORATION**

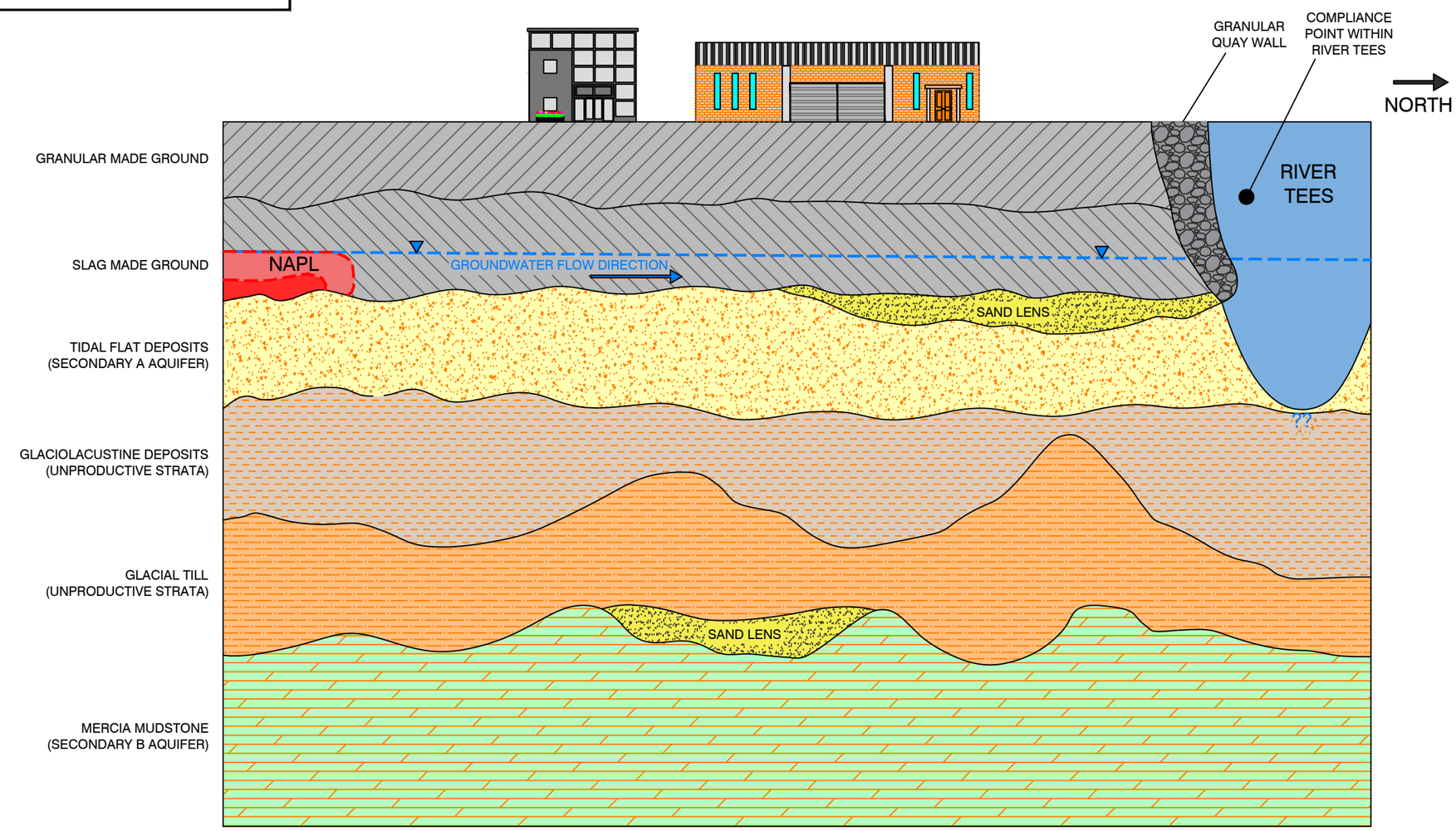
PROJECT :	**10035117**	**FIGURE 3af**	
DATE :	10/09/21	DRAWN BY :	AP
DRG No. :	10035117-AUK-XX-XX-DR-ZZ-0405-P1 GIS		
SCALE :	**1 : 7,000**	PRINT :	**A3**

ARCADIS Design & Consultancy for natural and built assets

COMMERCIAL / INDUSTRIAL END USE CSM



CONCEPTUAL ZONE	PHYSICAL CHARACTERISTICS	JUSTIFICATION
UNSATURATED ZONE	GRANULAR MADE GROUND - SANDY GRAVEL WITH VARYING COBBLE CONTENT	REPRESENTATIVE OF DEPOSITS IMMEDIATELY ABOVE THE SOURCE ZONE
SOURCE ZONE	SLAG MADE GROUND - SANDY GRAVEL & COBBLES (>50% SLAG)	REPRESENTATIVE OF DEPOSITS WITHIN WHICH THE MAJORITY OF IMPACTS ARE LOCATED
AQUIFER	SLAG MADE GROUND - SANDY GRAVEL & COBBLES (>50% SLAG)	REPRESENTATIVE OF THE DEPOSITS ENCOUNTERED BENEATH THE SITE, THROUGH WHICH OFF-SITE MIGRATION OF GROUNDWATER IS ANTICIPATED TO TAKE PLACE



KEY

NOTES

INDICATIVE - NOT TO SCALE

SBCO - SOUTH BANK COKE OVEN

DNAPL - DENSE NON-AQUEOUS PHASE LIQUID

MADE GROUND IS ALSO CONSIDERED A SOURCE OF DIFFUSE CONTAMINANTS - NOT DEPICTED FOR SIMPLICITY.

REV	DATE	COMMENT	CAD

TITLE: WATER RESOURCES CONCEPTUAL SITE MODEL

SITE: REDCAR SOUTH BANK

CLIENT: SOUTH TEES DEVELOPMENT CORPORATION

PROJECT: 10035117 | FIGURE 4

DATE: 16/07/21 | DRAWN: BNB | REV: -

DRG.No.: 10035117-AUK-XX-XX-DR-ZZ-0011-P1 | PRINT: A3

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Tables

Redcar South Bank

Table 1: Selection of Contaminants of Concern to Model

Analyte	Units	Environmental Quality Standard**	Number of Detects	Number of Samples Analysed	Maximum Concentration	Average Concentration	Exceeds Environmental Quality Standard	Consider Further?	Justification
Speciated Total Petroleum Hydrocarbons and Fuel Indicators									
>C5-C6 Aliphatics	µg/L	See TPH	2	203	240	2.4	~	Yes	Assessed in line with UK guidance for the assessment of petroleum hydrocarbon contamination (EA, 2005) which recommends the use of speciated TPH fractions combined with selected indicator compounds. Total xylenes has been adopted for the assessment of m&p xylenes and o xylenes.
>C6-C8 Aliphatics	µg/L	See TPH	15	203	1400	24	~	Yes	
>C8-C10 Aliphatics	µg/L	See TPH	19	203	490	7.1	~	Yes	
>C10-C12 Aliphatics	µg/L	See TPH	38	203	790	6.2	~	Yes	
>C12-C16 Aliphatics	µg/L	See TPH	46	203	1100	8.1	~	Yes	
>C16-C21 Aliphatics	µg/L	See TPH	64	203	140	7.8	~	Yes	
>C21-C35 Aliphatics	µg/L	See TPH	43	203	98	4.9	~	Yes	
Total >C5-C35 Aliphatics	µg/L	See TPH	59	148	1500	64	~	Yes	
>EC5-EC7 Aromatics	µg/L	See TPH	28	203	59000	383	~	Yes	
>EC7-EC8 Aromatics	µg/L	See TPH	14	203	5900	85	~	Yes	
>EC8-EC10 Aromatics	µg/L	See TPH	14	203	1100	12	~	Yes	
>EC10-EC12 Aromatics	µg/L	See TPH	59	203	8900	161	~	Yes	
>EC12-EC16 Aromatics	µg/L	See TPH	61	203	2500	87	~	Yes	
>EC16-EC21 Aromatics	µg/L	See TPH	54	203	280	7.6	~	Yes	
>EC21-EC35 Aromatics	µg/L	See TPH	31	203	42	2.5	~	Yes	
Total >EC5-EC35 Aromatics	µg/L	See TPH	55	148	76000	986	~	Yes	
Sum TPH >C5-C35 Ali & Aro	µg/L	50[#1]	78	148	76000	1046	Yes	Yes	
Sum TPH >C5-C44 Ali & Aro	µg/L	50[#1]	20	55	2886	124	Yes	Yes	
Benzene	µg/L	8[#2]	40	182	47000	843	Yes	Yes	
Toluene	µg/L	74[#2]	30	182	4500	87	Yes	Yes	
Ethylbenzene	µg/L	20[#3]	15	182	42	1.4	Yes	Yes	
Xylene (m & p)	µg/L	15[#4]	23	182	710	18	Yes	Yes[1]	
Xylene (o)	µg/L	15[#4]	27	182	210	6.6	Yes	Yes[1]	
Xylene Total	µg/L	30[#5]	22	67	920	45	Yes	Yes	
Polycyclic Aromatic Hydrocarbons									
Naphthalene	µg/L	2[#2]	143	203	11000	213	Yes	Yes	Indicator approach adopted for the assessment of Polycyclic Aromatic Hydrocarbons. The Polycylic Aromatic Hydrocarbons selected for further assessment comprise those for which Environmental Quality Standards are presented in the Water Framework Directive (WFD, 2015); namely naphthalene (representing one of the more mobile PAH), fluoranthene, anthracene and benzo(a)pyrene (in line with the WFD, 2015, benzo(a)yrene is considered to represent an indicator for the assessment of benzo(b/k)fluoranthene, benzo(g,h,i)perylene and indeno(1,2,3-c,d)pyrene).
Acenaphthene	µg/L	~	183	203	890	34	~	Yes[1]	
Acenaphthylene	µg/L	~	148	203	270	4.6	~	Yes[1]	
Fluoranthene	µg/L	0.0063[#2]	149	203	260	1.1	Yes	Yes	
Anthracene	µg/L	0.1[#2]	135	203	52	0.83	Yes	Yes	
Phenanthrene	µg/L	~	163	203	310	3.1	~	Yes[1]	
Fluorene	µg/L	~	169	203	240	9.6	~	Yes[1]	
Chrysene	µg/L	~	43	203	84	0.4	~	Yes[1]	
Pyrene	µg/L	~	163	203	190	0.82	~	Yes[1]	
Benzo(a)anthracene	µg/L	~	46	203	100	0.45	~	Yes[1]	
Benzo(b)fluoranthene	µg/L	See BaP[#6]	42	203	110	0.49	~	Yes[1]	
Benzo(k)fluoranthene	µg/L	See BaP[#6]	33	203	61	0.36	~	Yes[1]	
Benzo(a)pyrene	µg/L	0.00017[#6]	32	203	100	0.44	Yes	Yes	
Dibenz(a,h)anthracene	µg/L	~	22	203	15	0.19	~	Yes[1]	
Benzo(g,h,i)perylene	µg/L	See BaP[#6]	43	203	45	0.29	~	Yes[1]	
Indeno(1,2,3-c,d)pyrene	µg/L	See BaP[#6]	42	203	74	0.38	~	Yes[1]	
PAHs (Sum of total)	µg/L	~	162	203	11000	306	~	Yes[1]	
Metals									
Aluminium	µg/L	~	10	10	190	55	~	Yes[1]	Indicator approach adopted for the assessment of metals, which were detected in the majoriy of samples analysed. The metals selected for further assessment comprise those for which Environmental Quality Standards are readily available. While arsenic and vanadium did not exceed the relevant EQS, they have been included for completeness.
Antimony	µg/L	~	9	10	0.98	0.39	~	Yes[1]	
Arsenic	µg/L	25[#2]	30	30	6.6	1.5	No	Yes	
Arsenic (Filtered)	µg/L	25[#2]	173	173	17	2.5	No	Yes	
Barium	µg/L	~	10	10	140	72	~	Yes[1]	
Barium (Filtered)	µg/L	~	55	55	84	37	~	Yes[1]	
Beryllium (Filtered)	µg/L	~	2	55	0.2	0.055	~	Yes[1]	
Boron	µg/L	7000[#5]	29	30	1500	757	Yes	Yes	
Boron (Filtered)	µg/L	7000[#5]	173	173	57000	3642	Yes	Yes	
Cadmium	µg/L	0.2[#7]	8	30	0.14	0.027	Yes	Yes	
Cadmium (Filtered)	µg/L	0.2[#7]	39	173	0.49	0.033	Yes	Yes	
Chromium (hexavalent)	µg/L	0.6[#7]	11	203	280	6.2	Yes	Yes	
Chromium	µg/L	0.6[#7]	113	142	160	6.6	Yes	Yes	
Chromium (Filtered)	µg/L	0.6[#7]	8	12	4.8	0.81	Yes	Yes	
Chromium (Trivalent)	µg/L	~	27	88	3	1	~	Yes[1]	
Chromium (Trivalent) (Filtered)	µg/L	~	12	67	5	0.69	~	Yes[1]	
Copper	µg/L	3.76[#9]	18	30	11	1.4	Yes	Yes	
Copper (Filtered)	µg/L	3.76[#9]	103	173	18	1.3	Yes	Yes	
Iron	µg/L	1000[#2]	29	30	2000	243	Yes	Yes	
Iron (Filtered)	µg/L	1000[#2]	135	135	7700	438	Yes	Yes	
Lead	µg/L	1.3[#7]	17	30	4.4	1.5	Yes	Yes	
Lead (Filtered)	µg/L	1.3[#7]	130	173	63	0.88	Yes	Yes	
Manganese	µg/L	~	20	20	4300	701	~	Yes[1]	
Mercury	µg/L	0.07[#10]	19	30	0.55	0.071	Yes	Yes	
Mercury (Filtered)	µg/L	0.07[#10]	98	173	0.43	0.038	Yes	Yes	
Molybdenum	µg/L	~	28	30	100	21	~	Yes	
Molybdenum (Filtered)	µg/L	~	127	135	110	20	~	Yes	
Nickel	µg/L	8.6[#7]	26	30	6.6	1.5	Yes	Yes	
Nickel (Filtered)	µg/L	8.6[#7]	154	173	67	3.1	Yes	Yes	
Selenium (Filtered)	µg/L	~	54	55	12	4.2	~	Yes[1]	
Vanadium	µg/L	100	9	10	4.1	1.3	No	Yes	
Vanadium (Filtered)	µg/L	100	43	55	7.8	1.4	No	Yes	
Zinc	µg/L	7.9	26	30	61	15	Yes	Yes	
Zinc (Filtered)	µg/L	7.9	138	173	300	9.2	Yes	Yes	

Notes

* Includes contaminants of concern measured above the laboratory method detection limit during groundwater monitoring undertaken between October 2020 and June 2021 across the South Bank Redcar site (i.e. between one and three sampling events per monitoring well location, depending on the date of installation of the monitoring well). Compounds that are present in seawater (primarily associated with inorganics such as magnesium, chloride and carbonate), have not been included given that a large proportion of the land included within the Site boundary is relaimed land.

** Environmental Quality Standards adopted for the purpose of deriving Site Specific Assessment Criteria. Further contaminant specific details are provided in the notes below, along with the source of the Enviornmental Quality Standard.

~ No Environmental Quality Standards readily available

Yes[1] Compound indirectly assessed through the use of indicator compounds

Yes Compound exceeds Environmental Quality Standard

Yes Compound considered to require further consideration following screening

#1:No UK EQS for total petroleum hydrocarbons (TPH), or speciated TPH fractions. A value of 50 µg/l is adopted for sum TPH protection of surface water based on 50µg/l-1000µg/l (Surface Waters (Abstraction for Drinking Water) Regulations 1989). For the purpose of calculating Site Specific Assessment Criteria, the standard of 50 µg/l has been split between the 11 TPH fractions assessed (i.e. compliance criteria of 4.5 µg/l).
#2:Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.
#3:Proposed Environmental Quality Standard, in absence of legislative standard (Ayscough et al., 2002). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291223/sp2-115-tr4-e-e.pdf
#4:Operational Targets and EQS. EA, April 2018. Value of 30µg/l for sum xylenes split between isomers. Requires summation of m,p & o isomers to use 30µg/l value.
#5:Operational Targets and EQS. EA, April 2018
#6:Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. Benzo(a)pyrene can be considered as a marker for other PAH for comparison with the corresponding AA-EQS in water.
#7:Water Framework Directive (Standards & Classification) Directions (England & Wales) 2015. Dissolved fraction.
#8:Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. Value of 20µg/l for sum isomers split between 3 isomers.
#9:Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. Dissolved Fraction. If DOC >1mg/l then a higher criteria may be applied, however this value has been adopted as an initial screening value.
#10:Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. Dissolved Fraction. MAC adopted in absence of AA value.
#11:Operational Targets and EQS. EA, April 2018.
#12:Operational Targets and EQS. EA, April 2018. Dissolved plus ambient background concentration. For saltwater, an Ambient Background Concentration of 1.1 µg/l has been used as an initial screening value.
#13: European Chemicals Agency, REACH database, accessed 3 September 2021 (https://www.echa.europa.eu/information-on-chemicals/registered-substances).
#14: Value for phenols adopted in the absence of a value for monohydric phenols.

Redcar South Bank

Table 1: Selection of Contaminants of Concern to Model

Analyte	Units	Environmental Quality Standard**	Number of Detects	Number of Samples Analysed	Maximum Concentration	Average Concentration	Exceeds Environmental Quality Standard	Consider Further?	Justification
Volatile and Semi Volatile Organic Compounds									
Styrene	µg/L	50[#5]	7	182	43	1.1	No	No	No exceedances of the Environmental Quality Standard identified.
1,2-dibromo-3-chloropropane	µg/L	~	1	182	17	0.59	~	No	Measured above MDL in only one of 67 samples analysed, with the detection identified in one location during one of three sampling events.
Bromochloromethane	µg/L	~	1	182	4	2	~	No	Measured above MDL in only one of >150 samples and generally in the same order of magnitude as the limit of detection. Where an Environmental Quality Standard was available for comparison (trichloroethene), no exceedance was identified.
2-chlorotoluene	µg/L	~	1	182	2	0.51	~	No	
Chloroethane	µg/L	~	1	182	1	0.5	~	No	
Trichloroethene	µg/L	10[#2]	1	182	1	0.5	No	No	
2-nitroaniline	µg/L	~	1	163	4.7	1.4	~	No	
3-nitroaniline	µg/L	~	1	163	2.6	1.3	~	No	
4-chloro-3-methylphenol	µg/L	40[#5]	1	163	1.2	0.5	No	No	
Bis(2-ethylhexyl)ester	µg/L	~	1	152	1	1	~	No	
Di-n-octyl phthalate	µg/L	20[#5]	1	163	9	1.4	No	No	
1,2-dichloroethane	µg/L	10[#2]	11	182	85	1.5	Yes	Yes	Measured above MDL in approximatley 6% of samples analysed with the maximum concentration exceeding the Environmental Quality Standard.
1,2-dichloropropane	µg/L	8[#13]	7	182	13	0.89	Yes	Yes	Measured above MDL in approximatley 4% of samples analysed with the maximum concentration an order of magnitude higher than the laboratory detection limit.
4-chlorotoluene	µg/L	~	2	182	1	0.51	~	No	Measured above MDL in only two of 67 samples analysed, at the laboratory detection limit.
Bromodichloromethane	µg/L	~	6	182	6	2.1	~	Yes[1]	No environmental quality standard identified. Risk assessed via the more prevalent trihalomethane, chloroform, using indicator compound approach. Measured in a limited number of locations (<5% of samples).
Chlorodibromomethane	µg/L	~	3	182	1	0.51	~	Yes[1]	
Chloroform	µg/L	2.5[#2]	19	182	30	1.5	Yes	Yes	Measured above MDL in approximatley 10% of samples analysed with the maximum concentration exceeding the Environmental Quality Standard.
1,2-dichlorobenzene	µg/L	6.7[#8]	5	182	6	0.6	No	No	No exceedances of the Environmental Quality Standard identified.
1,4-dinitrobenzene	µg/L	~	11	163	17	1.6	~	Yes[1]	Indicator approach adopted. No EQS were identified, with the exception of a predicted no effects concentration (PNEC) for aniline ublished on the European Chemicals Agency (ECHA) REACH database, which measured concentrations exceed. Based on prevalence, availability of data and that aniline was measured at the highest concentration in this group, aniline has been adopted as an indicator compound.
4-nitroaniline	µg/L	~	4	163	8.8	1.4	~	Yes[1]	
Aniline	µg/L	1.2[#13]	11	163	220	3.4	Yes	Yes	
Azobenzene	µg/L	~	2	163	3.3	1.3	~	Yes[1]	
2-methylnaphthalene	µg/L	~	23	163	620	7.6	~	Yes[1]	Indicator approach adopted. The compounds detected are typically associated with petroleum hydrocarbons, with the detections corresponding with samples in which petroleum hydrocarbons were also detected. As such, the remaining petroleum hydrocarbons, PAH and indicators included within the assessment are considered to represent appropriate indicators for the assessment of these compounds.
1-Methylnaphthalene	µg/L	~	31	163	390	8.8	~	Yes[1]	
tert-butylbenzene	µg/L	~	5	182	8	0.6	~	Yes[1]	
1,3,5-trimethylbenzene	µg/L	~	23	182	44	1.8	~	Yes[1]	
1,2,4-trimethylbenzene	µg/L	~	14	182	55	1.8	~	Yes[1]	
Isopropylbenzene	µg/L	~	6	182	5	0.6	~	Yes[1]	
p-isopropyltoluene	µg/L	~	2	182	8	0.55	~	Yes[1]	
Carbazole	µg/L	~	20	163	89	2.9	~	Yes[1]	
Dibenzofuran	µg/L	~	34	163	310	9	~	Yes[1]	
Bis(2-ethylhexyl) phthalate	µg/L	1.3[#2]	16	163	12	1.5	Yes	Yes	Measured above MDL in approximatley 10% of samples analysed with the maximum concentration exceeding the Environmental Quality Standard.
Diethylphthalate	µg/L	200[#5]	8	163	6	1.4	No	No	No exceedances of the Environmental Quality Standard identified.
Di-n-butyl phthalate	µg/L	8[#5]	9	163	2.8	1.4	No	No	No exceedances of the Environmental Quality Standard identified.
Benzyl alcohol	µg/L	~	31	163	5.9	1.6	~	No	No EQS identified. Measured above MDL in approximately 20% of samples. Information published on the European Chemicals Agency (ECHA) REACH database cites a No effects concentration (NOEC) of 51mg/l (51,000µg/l) from a 2009 Japanese study. Benzyl alcohol is related to phenolic compounds, which are discussed below. Based on this, measured concentrations are unlikely to warrant further assessment.
2-methylphenol	µg/L	~	13	163	2300	26	~	Yes[1]	Phenol and monohydric phenols adopted as indicators for the assessment of phenolic compounds, which were typically detected in a number of samples and at concentrations several orders of magnitude above the limit of detection. Phenol and monohydric phenols adopted on the basis that typically they were the highest concentrations measured, with the remaining phenolic compounds generally detected in the same locations.
4-nitrophenol	µg/L	~	11	163	55	2.1	~	Yes[1]	
2,4-dimethylphenol	µg/L	~	25	163	1100	13	~	Yes[1]	
Xylenols	µg/L	~	11	135	190	1.6	~	Yes[1]	
Xylenols & Ethyl Phenols	µg/L	~	2	55	5	0.15	~	Yes[1]	
3-&4-methylphenol	µg/L	~	11	163	6100	56	~	Yes[1]	
Cresol Total	µg/L	~	20	173	5200	33	~	Yes[1]	
Phenol	µg/L	7.7[#2]	33	184	4000	37	Yes	Yes	
Total Phenols	µg/L	~	9	61	8.4	1.4	~	Yes[1]	
Phenols Monohydric	µg/L	7.7[#14]	12	42	16000	1162	Yes	Yes	
Other Inorganics									
Ammoniacal Nitrogen as N	mg/L	0.021[#2]	193	203	360	16	Yes	Yes	Detected in nearly all samples analysed at concentrations several orders of magnitude higher than the laboratory detection limit. While ammoniacal nitrogen as N is naturally occuring in the environment, it has also been linked to specific activities undertaken on Site (such as ammonia scrubbers).
Cyanide (Free)	µg/L	~	46	203	420	10	~	Yes[1]	Total cyanide has been adopted for the assessment of free and complex cyanide, given that the readily avaiable Environmental Quality Standard is for total cyanide.
Cyanide Total	µg/L	1[#2]	125	203	3800	105	Yes	Yes	
cyanides-complex	µg/L	~	53	55	140	31	~	Yes[1]	
Thiocyanate (as SCN)	µg/L	9[#13]	88	165	1700000	27126	Yes	Yes	Detected in approximatley 53% of samples analysed with several measured concentrations above the EQS.

Notes

*	Includes contaminants of concern measured above the laboratory method detection limit during groundwater monitoring undertaken between October 2020 and June 2021 across the South Bank Redcar site (i.e. between one and three sampling events per monitoring well location, depending on the date of installation of the monitoring well). Compounds that are present in seawater (primarily associated with inorganics such as magnesium, chloride and carbonate), have not been included given that a large proportion of the land included within the Site boundary is relaimed land.
**	Environmental Quality Standards adopted for the purpose of deriving Site Specific Assessment Criteria. Further contaminant specific details are provided in the notes below, along with the source of the Enviornmental Quality Standard.
~	No Environmental Quality Standards readily available
Yes[1]	Compound indirectly assessed through the use of indicator compounds
Yes	Compound exceeds Environmental Quality Standard
Yes	Compound considered to require further consideration following screening

#1:No UK EQS for total petroleum hydrocarbons (TPH), or speciated TPH fractions. A value of 50 µg/l is adopted for sum TPH protection of surface water based on 50µg/l-1000µg/l (Surface Waters (Abstraction for Drinking Water) Regulations 1989). For the purpose of calculating Site Specific Assessment Criteria, the standard of 50 µg/l has been split between the 11 TPH fractions assessed (i.e. compliance criteria of 4.5 µg/l).
#2:Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.
#3:Proposed Environmental Quality Standard, in absence of legislative standard (Ayscough et al., 2002). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291223/sp2-115-tr4-e-e.pdf
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#14: Value for phenols adopted in the absence of a value for monohydric phenols.

Redcar South Bank

Table 2: Water Resources Site Specific Assessment Criteria

Compound	Theoretical Solubility (µg/l)	Water Resources Site Specific Assessment Criteria (µg/l) - with dilution
Speciated Total Petroleum Hydrocarbons and Fuel Indicators		
>C5-C6 Aliphatics	36,000	1,360
>C6-C8 Aliphatics	5,400	1,360
>C8-C10 Aliphatics	430	>SOL
>C10-C12 Aliphatics	34	>SOL
>C12-C16 Aliphatics	0.76	>SOL
>C16-C35 Aliphatics	1.30E-03	>SOL
>C21-C35 Aliphatics		
>EC8-EC10 Aromatics	65,000	1,360
>EC10-EC12 Aromatics	25,000	1,360
>EC12-EC16 Aromatics	5,800	1,360
>EC16-EC21 Aromatics	510	>SOL
>EC21-EC35 Aromatics	6.6	>SOL
Benzene	1.78E+06	2,400
Toluene	5.90E+05	22,200
Ethylbenzene	1.80E+05	5,990
Xylene Total	1.91E+05	8,990
Polycyclic Aromatic Hydrocarbons		
Naphthalene	19,000	599
Fluoranthene	230	1.89
Anthracene	70	30
Benzo(a)pyrene	3.8	0.0509
Metals		
Arsenic	1.25E+09	7,490
Boron	6.35E+07	2,100,000
Cadmium	1.62E+09	59.9
Chromium (hexavalent)	8.76E+08	180
Total Chromium	8.76E+08	180
Copper	1.38E+08	1,130
Iron	1.00E+09**	300,000
Lead	2.96E+08	390
Mercury	7.40E+07	21
Nickel	2.50E+09	2,580
Vanadium	2.11E+08	30,000
Zinc	4.32E+09	2,370
Volatile and Semi Volatile Organic Compounds		
1,2-dichloroethane	8.68E+06	3,000
1,2-dichloropropane	2.80E+06	2,400
Chloroform	8.95E+06	749
Aniline	3.50E+07	360
Bis(2-ethylhexyl) phthalate	3.00E+02	>SOL
Phenol	8.41E+07	2,310
Phenols Monohydric	8.41E+07	2,310
Other Inorganics		
Cyanide Total	1.00E+09**	300
Thiocyanate (as SCN)	1.00E+09**	2,700
Ammoniacal Nitrogen as N	1.00E+09**	6,290

Notes

*	Includes contaminants of concern identified following screening undertaken in Table 1.
**	Theoretical solubility assumed to be 1 x 10^9µg/l in the absence of a readily available solubility limits
>SOL	Results of risk assessment demonstrate pathway does not present significant level of risk.

Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	South Bank Area A																				
					BH-2010			BH-2011			BH-2013			BH-2014			BH-2015			BH-2016			BH-2017		
	Well Installatior				A			A			A			A			A			A			A		
	Sample Date	Dat			16/02/2021	09/03/2021	03/08/2021	16/02/2021	09/03/2021	03/08/2021	16/02/2021	08/03/2021	03/08/2021	16/02/2021	08/03/2021	03/08/2021	15/02/2021	08/03/2021	03/08/2021	15/02/2021	08/03/2021	03/08/2021	15/02/2021	08/03/2021	03/08/2021
Total Petroleum Hydrocarbons and Fuel Indicators																									
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	11	<1	<1	<1	<1	<1	71	6	<1	<1	4.8	<1	<1	<1	<1	<1	4.5
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	18	<1	<1	<1	<1	<1	12	11	<1	<1	9	<1	<1	<1	<1	<1	8.8
>C16-C35 Aliphatics	µg/L		4.55	>SOL	<2	<2	-	<2	<2	<2	-	<2	<2	-	<2	<2	<2	-	<2	<2	-	<2	<2	-	<2	<2	-
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	42	<1	25	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	5.2	<1	<1	5	<1	<1	6
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	73	<1	51	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	22	<1	<1	4.9	<1	<1	3.6
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	26	<1	6.1	<1	<1	<1	17	<1	<1	<1	<1	<1	<1	<1	<1	<1	15	<1	<1	7.2	<1	<1	15
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	<1	<1	3.8	<1	<1	<1	18	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	10
Benzene	µg/L	1	8	2400	-	<1	<1	<1	-	-	<1	-	-	<1	-	-	-	<1	1	-	<1	<1	<1	<1	<1	-	<1
Toluene	µg/L	1	74	22200	-	<1	<1	<1	-	-	<1	-	-	<1	-	-	-	<1	<1	-	<1	<1	<1	<1	<1	-	<1
Ethylbenzene	µg/L	1	20	5990	-	<1	<1	<1	-	-	<1	-	-	<1	-	-	-	<1	<1	-	<1	<1	<1	<1	<1	-	<1
Xylene Total	µg/L		30	8990	-	<3	-	<3	-	-	-	-	-	-	-	-	-	<1	<3	-	-	<3	<3	-	<3	-	-
Polycyclic Aromatic Hydrocarbons																									
Naphthalene	µg/L	0.05	2	599	110	91	<0.05	1.9	<0.05	1	<0.05	0.07	0.78	<0.5	0.07	0.11	0.12	4.2	0.83	0.54	1	0.1	<0.05	<0.05	<0.05	<0.05	0.06
Fluoranthene	µg/L	0.01	0.0063	1.89	0.04	0.06	0.02	0.01	<0.01	<0.01	<0.01	0.02	0.17	0.1	0.01	0.01	0.03	<0.1	0.04	0.05	<0.1	0.01	0.01	<0.01	0.01	0.02	0.01
Anthracene	µg/L	0.01	0.1	30	0.15	0.1	0.06	0.02	<0.01	<0.01	<0.01	<0.01	0.06	<0.1	<0.01	<0.01	<0.01	<0.1	<0.01	0.04	<0.1	<0.01	<0.01	<0.01	0.02	<0.01	<0.01
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	0.12	<0.01	<0.01	<0.01	0.1	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Metals																									
Arsenic	µg/L	0.16	25	7490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	0.16	25	7490	3.3	2.3	2.9	1.8	2.8	2.5	2.3	2.8	4	3.3	1.6	3	1.6	1.7	2.5	1.8	5.1	2.1	2	1.3	2	2.4	1.7
Boron	µg/L	12	7000	2100000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (Filtered)	µg/L	12	7000	2100000	1,500	1,700	1,300	4,700	2,500	3,100	2,200	2,000	1,900	1,900	1,400	1,500	1,100	1,300	1,600	1,100	1,500	3,500	2,400	2,100	4,100	4,300	2,400
Cadmium	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	<0.03	<0.03	<0.03	0.12	0.19	0.23	0.49	<0.03	0.08	<0.03	<0.03	0.12	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.04	0.06	<0.03	<0.03
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7
Chromium	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	µg/L	0.4	3.76	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (Filtered)	µg/L	0.4	3.76	1130	<0.4	<0.4	<0.4	0.9	0.9	1.2	1.4	1.2	2.5	<0.4	0.4	6.1	<0.4	<0.4	<0.4	<0.4	<0.4	0.8	0.7	1.1	1	0.6	<0.4
Iron	µg/L	5.5	1000	300000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	5.5	1000	300000	-	-	210	-	-	-	230	-	-	800	-	-	-	9.2	-	-	210	-	-	7.8	-	-	9.3
Lead	µg/L	0.09	1.3	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Filtered)	µg/L	0.09	1.3	390	<0.09	0.15	0.78	0.16	0.52	0.94	0.2	0.54	63	1.3	0.14	11	0.73	<0.09	0.17	0.34	<0.09	0.23	6.4	0.63	0.4	0.35	<0.09
Mercury	µg/L	0.01	0.07	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (Filtered)	µg/L	0.01	0.07	21	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.05	<0.01	<0.01	0.08	0.04	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	µg/L	0.5	8.6	2580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	0.9	<0.5	0.9	11	8.9	11	67	3.1	2.1	2.7	<0.5	3.4	<0.5	<0.5	0.6	<0.5	<0.5	0.8	0.5	1.3	2.5	1.1	0.9
Vanadium	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	<0.6	0.7	1	0.8	1.4	1.4	1.1	1.3	4.1	3.3	1.6	7.8	2.3	0.8	0.6	<0.6	0.9	1.3	1.8	1.2	1.7	1.8	1
Zinc	µg/L	1.3	7.9	2370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	<1.3	<1.3	3	66	57	60	300	17	95	3.4	<1.3	17	<1.3	<1.3	2.1	<1.3	<1.3	5.2	7.2	13	9	<1.3	3
Volatile and Semi Volatile Organic Compounds																									
1,2-dichloroethane	µg/L	1	10	3000	-	<1	<1	<1	-	-	<1	-	-	<1	-	-	-	<1	<1	-	<1	<1	<1	<1	<1	-	<1
1,2-dichloropropane	µg/L	1	8	2400	-	<1	<1	<1	-	-	<1	-	-	<1	-	-	-	<1	<1	-	<1	7	12	<1	<1	-	<1
Chloroform	µg/L	1	2.5	749	-	<1	<1	<1	-	-	<1	-	-	<1	-	-	-	<1	<1	-	<1	<1	<1	<1	<1	-	<1
Phenol	µg/L	0.1	7.7	2310	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.63	<0.1	<0.1	<0.1
Phenols Monohydric	µg/L	100	7.7	2310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aniline	µg/L	1	1.2	360	-	<1	<1	<1	-	-	<1	-	-	<1	-	-	-	<1	<1	-	<1	<1	<1	<1	<1	-	<1
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	-	<1	<1	<1	-	-	3.8	-	-	<1	-	-	-	<1	<1	-	<1	<1	<1	<1	<1	-	<1
Other Inorganics																									
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	23	25	28	1.1	0.69	0.78	0.63	1.1	1.2	1.8	0.16	0.17	0.23	0.53	0.11	0.016	0.32	0.16	0.41	0.61	0.55	0.18	0.52
Cyanide Total	µg/L	0.1	1	300	110	110	160	32	12	11	<40 - 1.3	9.6	8.8	<40 - 4.3	5.3	4.5	6.4	<40 - 5.4	8.3	7.1	<40 - 3.5	21	9.4	<40 - 11	33	19	<40 - 25
Thiocyanate (as SCN)	µg/L	20	9	2700	-	-	100,000	-	-	-	<20	-	-	34	-	-	-	36	-	-	35	-	-	<20	-	-	<20

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

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Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	South Bank Area A																	
					BH-2019			BH-2020			BH-2021			BH-2022			BH-2024			BH-2025		
Well Installation					A			A			A			A			A			A		
Sample Date	Dat				15/02/2021	08/03/2021	03/08/2021	15/02/2021	08/03/2021	03/08/2021	15/02/2021	08/03/2021	03/08/2021	15/02/2021	08/03/2021	03/08/2021	15/02/2021	08/03/2021	03/08/2021	15/02/2021	08/03/2021	03/08/2021
Total Petroleum Hydrocarbons and Fuel Indicators																						
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.3
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	6.6	<1	<1	40	<1	<1	4.8	<1	<1	40	<1	<1	790
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	8.7	<1	<1	18	<1	<1	4.8	<1	<1	15	<1	<1	1,100
>C16-C35 Aliphatics	µg/L		4.55	>SOL	<2	<2	-	<2	<2	-	<2	<2	-	<2	<2	-	<2	<2	-	<2	<2	-
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	8.9	<0.1	5.8
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	<1	<1	5.1	<1	<1	4.8	<1	<1	8.3	<1	<1	7.6	<1	<1	13	630	220	330
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	<1	<1	6	<1	<1	41	<1	<1	13	<1	<1	8.6	<1	<1	16	770	670	400
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	<1	<1	12	<1	<1	14	<1	<1	2.5	<1	<1	23	<1	<1	2.2	21	26	20
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	<1	<1	2.9	<1	<1	4.6	<1	<1	<1	<1	<1	17	<1	<1	<1	<1	<1	18
Benzene	µg/L	1	8	2400	<1	-	<1	<1	-	<1	<1	-	<1	-	<1	<1	<1	<1	<1	70	61	130
Toluene	µg/L	1	74	22200	<1	-	<1	<1	-	<1	<1	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	1	20	5990	<1	-	<1	<1	-	<1	<1	-	<1	-	<1	<1	3	<1	<1	<1	<1	<1
Xylene Total	µg/L		30	8990	<3	-	-	<3	-	-	<3	-	-	-	<3	-	7	<3	-	4	5	-
Polycyclic Aromatic Hydrocarbons																						
Naphthalene	µg/L	0.05	2	599	<0.05	0.07	0.07	<0.05	<0.05	0.57	<0.05	<0.05	0.19	0.05	<0.05	0.07	<0.05	<0.05	0.18	500	280	<0.05
Fluoranthene	µg/L	0.01	0.0063	1.89	0.01	0.08	0.01	0.03	0.07	0.03	0.01	0.01	0.02	0.02	0.01	<0.01	<0.01	<0.01	0.01	0.22	0.47	0.29
Anthracene	µg/L	0.01	0.1	30	0.02	<0.01	<0.01	0.02	0.02	0.08	<0.01	<0.01	0.02	0.02	<0.01	<0.01	<0.01	<0.01	0.02	6.4	2.2	2.4
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Metals																						
Arsenic	µg/L	0.16	25	7490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	0.16	25	7490	1.1	1.8	1.4	1.6	1.6	1.2	1.7	2.3	1.4	2.1	2.5	1.7	1.3	1.1	0.67	0.94	0.63	0.52
Boron	µg/L	12	7000	2100000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (Filtered)	µg/L	12	7000	2100000	3,300	2,400	2,200	2,100	2,900	2,100	1,500	1,300	2,100	1,400	1,300	1,900	1,400	1,100	1,200	690	540	580
Cadmium	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	0.05	0.06	0.06	0.03	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	8.6	<7
Chromium	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	µg/L	0.4	3.76	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (Filtered)	µg/L	0.4	3.76	1130	0.9	1.6	1.3	0.8	<0.4	1.1	2.3	1.8	1.9	2	1.7	1.8	<0.4	<0.4	<0.4	0.7	0.4	<0.4
Iron	µg/L	5.5	1000	300000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	5.5	1000	300000	-	-	6.4	-	-	7.8	-	-	25	-	-	8.7	-	-	62	-	-	45
Lead	µg/L	0.09	1.3	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Filtered)	µg/L	0.09	1.3	390	0.16	0.45	0.47	<0.09	0.16	<0.09	0.45	0.53	0.2	0.3	0.48	0.18	<0.09	0.15	0.16	0.18	0.16	0.1
Mercury	µg/L	0.01	0.07	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (Filtered)	µg/L	0.01	0.07	21	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	µg/L	0.5	8.6	2580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	0.8	2.1	1.3	<0.5	<0.5	0.6	2.8	1.7	1.6	2.3	1.3	1.2	<0.5	<0.5	0.8	0.8	<0.5	<0.5
Vanadium	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	1.9	2.3	1.6	2.8	3.1	2.2	1.4	2.2	1.5	1.6	2.1	1.3	<0.6	0.9	<0.6	1.3	1.1	<0.6
Zinc	µg/L	1.3	7.9	2370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	4.2	<1.3	4.1	1.6	<1.3	<1.3	4.9	<1.3	5.5	7.4	<1.3	1.6	1.4	<1.3	11	3.7	<1.3	<1.3
Volatile and Semi Volatile Organic Compounds																						
1,2-dichloroethane	µg/L	1	10	3000	<1	-	<1	<1	-	<1	<1	-	<1	-	<1	<1	<1	<1	<1	4	3	<1
1,2-dichloropropane	µg/L	1	8	2400	<1	-	<1	7	-	<1	<1	-	<1	-	12	<1	<1	12	<1	<1	12	<1
Chloroform	µg/L	1	2.5	749	<1	-	<1	<1	-	<1	<1	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1
Phenol	µg/L	0.1	7.7	2310	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.21
Phenols Monohydric	µg/L	100	7.7	2310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aniline	µg/L	1	1.2	360	<1	-	<1	<1	-	<1	<1	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	<1	-	1.9	<1	-	1.5	<1	-	<1	-	<1	<1	<1	<1	<1	<1	<1	<1
Other Inorganics																						
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	0.62	0.48	0.69	<0.015	5.3	0.56	1.5	0.49	0.47	0.69	0.73	0.47	24	25	20	11	10	10
Cyanide Total	µg/L	0.1	1	300	46	19	<40 - 10	20	23	<40 - 37	8.8	6.6	<0.1	11	10	<0.1	32	34	<40 - 7.1	71	50	41 - 80
Thiocyanate (as SCN)	µg/L	20	9	2700	-	-	<20	-	-	<20	-	-	<20	-	-	<20	-	-	23	-	-	36

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

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Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	South Bank Area A																			
					SBA_AUK_BH101				SBA_AUK_BH102			SBA_AUK_BH103								SBA_AUK_BH104			
	Well Installation				D				A			D				S				D			
	Sample Date	Data			08/10/2020	20/10/2020	12/11/2020	03/08/2021	08/10/2020	20/10/2020	12/11/2020	08/10/2020	21/10/2020	11/11/2020	03/08/2021	08/10/2020	21/10/2020	11/11/2020	03/08/2021	08/10/2020	20/10/2020	11/11/2020	03/08/2021
Total Petroleum Hydrocarbons and Fuel Indicators																								
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	230	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	8.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	550	620	300	<1	140	120	130	<0.1	<0.1	<0.1	1,400	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.6	<0.1	<0.1	<1	26	13	18	9.4	<0.1	<0.1	90	<0.1
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	16	<1	<1	<1	<1	<1	<1	<1	<1	22	12	<1	<1	26	<1	<1	<1	<1
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	45	<1	<1	<1	24	<1	<1	<1	<1	2.4	120	<1	<1	5	<1	<1	<1	<1
>C16-C35 Aliphatics	µg/L		4.55	>SOL	<2	218	<2	-	61	155	<2	34	<2	<2	-	2.2	<2	<2	-	22.2	<2	<2	-
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3.6	<0.1	<0.1	<0.1	34	<0.1	<0.1	<0.1	<0.1
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	<1	<1	<1	<1	<1	<1	<1	<1	<1	21	30	7.9	140	99	170	<1	<1	<1	<1
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	<1	12	<1	<1	<1	<1	<1	<1	<1	39	16	140	480	860	710	<1	<1	<1	<1
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	<1	77	<1	<1	<1	<1	<1	<1	<1	<1	1.3	<1	6.9	7.4	6.3	<1	<1	<1	<1
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	<1	27	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.7	<1	<1	<1	<1	<1	<1
Benzene	µg/L	1	8	2400	13	<1	<1	<1	<1	<1	<1	410	470	270	680	110	120	150	98	<1	<1	1,400	<1
Toluene	µg/L	1	74	22200	2	<1	<1	<1	<1	<1	<1	4	4	<1	3	2	3	1	<1	<1	<1	4	<1
Ethylbenzene	µg/L	1	20	5990	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	4	3	5	4	<1	<1	9	<1
Xylene Total	µg/L		30	8990	<3	<3	<3	-	<3	<3	<3	8	4	6	-	25	16	26	-	<3	<3	152	-
Polycyclic Aromatic Hydrocarbons																							
Naphthalene	µg/L	0.05	2	599	4 - 300	<1 - 0.12	6 - 8	0.11	<1 - 1.2	<1 - 1.6	<1 - 0.25	<1 - 2.4	<1 - 0.08	4 - 36	30	5.2 - 100	94 - 880	20 - 63	<5	<1 - 1.1	<1 - 0.15	1.1 - 100	<0.05
Fluoranthene	µg/L	0.01	0.0063	1.89	<1 - 0.04	0.02	0.02	0.02	<1 - 0.01	0.02	0.01	<1 - 0.03	0.08	0.19	<0.1	<1 - 0.55	0.46	0.67	1.2	<1 - 0.02	0.02	0.04	<0.01
Anthracene	µg/L	0.01	0.1	30	<1 - 0.04	0.02	0.02	<0.01	<0.01	0.01	<0.01	<1 - 0.04	0.05	0.33	<0.1	<1 - 0.96	0.79	1.1	<1	<0.01	<0.01	0.05	<0.01
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	<0.1	<0.01	<0.01	<0.01	<1	<0.01	<0.01	<0.01	<0.01
Metals																							
Arsenic	µg/L	0.16	25	7490	2.7	2.6	2.3	-	0.48	0.32	0.56	1.7	1.5	1.6	-	1.9	1.5	1.5	-	1.8	1.4	1.2	-
Arsenic (Filtered)	µg/L	0.16	25	7490	-	-	-	1.7	-	-	-	-	-	-	2.3	-	-	-	1.7	-	-	-	0.62
Boron	µg/L	12	7000	2100000	340	410	350	-	1,000	1,400	1,500	820	850	950	-	950	960	970	-	430	450	560	-
Boron (Filtered)	µg/L	12	7000	2100000	-	-	-	350	-	-	-	-	-	-	1,200	-	-	-	950	-	-	-	600
Cadmium	µg/L	0.03	0.2	59.9	0.03	0.03	<0.03	-	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	-	<0.03	<0.03	<0.03	-	<0.03	<0.03	<0.03	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	-	-	-	<0.03	-	-	-	-	-	-	<0.03	-	-	-	<0.03	-	-	-	<0.03
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7
Chromium	µg/L	0.25	0.6	180	6.4	<0.25	<0.25	1.4	0.3	<0.25	<0.25	<0.25	<0.25	<0.25	0.26	<0.25	<0.25	<0.25	<0.25	5.9	0.26	0.45	1.3
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	µg/L	0.4	3.76	1130	5.6	0.6	0.5	-	0.8	0.6	<0.4	<0.4	0.7	<0.4	-	0.5	0.5	<0.4	-	1.7	1	2.1	-
Copper (Filtered)	µg/L	0.4	3.76	1130	-	-	-	0.7	-	-	-	-	-	-	1.1	-	-	-	0.9	-	-	-	0.7
Iron	µg/L	5.5	1000	300000	38	58	47	-	100	540	2,000	39	21	55	-	26	22	180	-	22	14	96	-
Iron (Filtered)	µg/L	5.5	1000	300000	-	-	-	93	-	-	-	-	-	-	51	-	-	-	31	-	-	-	99
Lead	µg/L	0.09	1.3	390	4.1	<0.09	<0.09	-	4.4	<0.09	<0.09	4	<0.09	0.16	-	4.1	<0.09	1.1	-	4.1	<0.09	<0.09	-
Lead (Filtered)	µg/L	0.09	1.3	390	-	-	-	<0.09	-	-	-	-	-	-	0.17	-	-	-	0.12	-	-	-	0.16
Mercury	µg/L	0.01	0.07	21	0.55	0.47	0.48	-	0.03	<0.01	0.01	0.02	<0.01	0.01	-	<0.01	<0.01	<0.01	-	0.12	0.05	0.01	-
Mercury (Filtered)	µg/L	0.01	0.07	21	-	-	-	0.33	-	-	-	-	-	-	<0.01	-	-	-	<0.01	-	-	-	<0.01
Nickel	µg/L	0.5	8.6	2580	1.4	1.4	1.2	-	1.2	1	1.9	0.6	0.7	0.7	-	<0.5	<0.5	<0.5	-	1.1	1.2	1.3	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	-	-	-	2.7	-	-	-	-	-	-	1.4	-	-	-	<0.5	-	-	-	1.6
Vanadium	µg/L	0.6	100	30000	4.1	-	-	-	0.6	-	-	0.8	-	-	-	1	-	-	-	2.2	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1.3	7.9	2370	1.9	31	2.9	-	3.2	61	1.4	1.5	13	2.2	-	<1.3	7.7	7.3	-	<1.3	61	<1.3	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	-	-	-	6.6	-	-	-	-	-	-	4.8	-	-	-	12	-	-	-	13
Volatile and Semi Volatile Organic Compounds																							
1,2-dichloroethane	µg/L	1	10	3000	<1	<1	<1	<1	<1	<1	<1	22	<1	26	<1	6	<1	9	<1	<1	<1	85	<1
1,2-dichloropropane	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1	2.5	749	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenol	µg/L	0.1	7.7	2310	1.2	-	-	3.7	1.1	-	-	2.7	-	-	23	1.2	-	-	0.92	<1	-	-	<0.1
Phenols Monohydric	µg/L	100	7.7	2310	220	<100	320	-	410	290	1,100	<100	<100	350	-	<100	<100	<100	-	<100	<100	<100	-
Aniline	µg/L	1	1.2	360	<1	-	-	2	<1	-	-	17	-	-	220	<1	-	-	<1	<1	-	-	<1
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	<1	-	-	<1	<1	-	-	<1	-	-	<1	2.7	-	-	<1	<1	-	-	<1
Other Inorganics																							
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	2.3	2.6	1.3	2.3	3.9	2.7	1.2	59	80	85	220	43	47	45	39	0.92	0.68	0.13	0.18
Cyanide Total	µg/L	0.1	1	300	<40	<40	<40	<40	<40	<40	<40	<40	52	65	57	47	54	49	44	<40	<40	<40	<40
Thiocyanate (as SCN)	µg/L	20	9	2700	92	66	53	47	<20	<20	<20	170	44	<20	670	<20	23	<20	<20	58	45	<20	29

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

ARCADIS

Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	South Bank Area A																			
					SBA_AUK_BH105			SBA_AUK_BH106				SBA_AUK_BH107				SBA_AUK_BH108				SBA_AUK_BH110			
	Well Installatior				A			D				D				D				A			
	Sample Date	Dat			08/10/2020	20/10/2020	11/11/2020	09/10/2020	21/10/2020	10/11/2020	03/08/2021	08/10/2020	21/10/2020	10/11/2020	03/08/2021	09/10/2020	21/10/2020	10/11/2020	03/08/2021	08/10/2020	20/10/2020	10/11/2020	03/08/2021
Total Petroleum Hydrocarbons and Fuel Indicators																								
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	240
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	530	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	180	<0.1	120	<0.1	<0.1	<0.1	<0.1	<0.1	640	<0.1	<0.1	32
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	72	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	11	<0.1	5.2	0.7	<0.1	<0.1	<0.1	<0.1	5	410	490	110
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	28	<1	<1	<1	<1
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.9	<1	<1	<1	<1
>C16-C35 Aliphatics	µg/L		4.55	>SOL	26	<2	<2	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-	<2	<2	<2	-
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	46	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1,100
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	870	<1	1,000	<1	<1	<1	190	180	<1	510	110	<1	<1	<1	15	2,300	<1	5,800	8,900
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	920	<1	1,600	<1	<1	<1	370	120	<1	280	71	<1	<1	<1	8	340	<1	1,200	1,600
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	3.5	<1	13	<1	<1	<1	28	1.7	<1	4	<1	<1	<1	<1	<1	45	<1	210	280
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	1.4	<1	<1	<1	<1	<1	28	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3.5	23
Benzene	µg/L	1	8	2400	330	<1	<1	4	2	<1	9	120	19	160	210	2	2	12	<1	47,000	24,000	31,000	37,000
Toluene	µg/L	1	74	22200	45	<1	<1	<1	<1	<1	<1	25	3	17	61	<1	<1	1	<1	4,500	2,600	3,300	4,400
Ethylbenzene	µg/L	1	20	5990	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	37	42
Xylene Total	µg/L		30	8990	94	3	<3	<3	<3	<3	-	25	<3	14	-	<3	<3	<3	-	890	468	920	-
Polycyclic Aromatic Hydrocarbons																								
Naphthalene	µg/L	0.05	2	599	<1 - 1,900	<1 - 0.85	<1 - 850	<1 - 0.13	<0.05	<0.05	<0.05	58 - 340	0.67 - 3	<1 - 440	250	<1 - 8	<0.05	<1 - 9	3.1	1,500 - 9,200	<2 - 7,500	6,100 - 11,000	7,900
Fluoranthene	µg/L	0.01	0.0063	1.89	<10 - 0.2	0.47	0.21	<1 - 0.08	0.02	0.02	0.19	<1 - 0.04	0.06	0.06	0.11	<1 - 0.02	0.05	<0.01	0.14	<100 - 260	2.2 - 11	25	15
Anthracene	µg/L	0.01	0.1	30	<10 - 1.1	2	0.98	<1 - 0.07	0.04	0.04	0.24	<1 - 0.16	0.09	0.34	0.23	<1 - 0.02	0.07	0.01	<0.1	<100 - 52	4 - 13	45	17
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	0.06	<0.01	0.02	<0.01	<0.1	<0.01	<0.01	<0.01	<0.1	<100 - 100	<2 - 1.5	2.2	4.4
Metals																								
Arsenic	µg/L	0.16	25	7490	1.3	0.84	0.31	0.95	1	0.87	-	1.1	0.68	1.2	-	1.3	1.7	2	-	1	6.6	0.7	-
Arsenic (Filtered)	µg/L	0.16	25	7490	-	-	-	-	-	-	2	-	-	-	1.2	-	-	-	6.2	-	-	-	0.78
Boron	µg/L	12	7000	2100000	520	510	<12	900	870	800	-	680	640	630	-	840	1,300	1,200	-	630	620	620	-
Boron (Filtered)	µg/L	12	7000	2100000	-	-	-	-	-	-	870	-	-	-	640	-	-	-	1,600	-	-	-	630
Cadmium	µg/L	0.03	0.2	59.9	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	-	<0.03	<0.03	0.04	-	<0.03	0.14	<0.03	-	0.09	0.06	<0.03	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	<0.03	-	-	-	<0.03	-	-	-	<0.03	-	-	-	<0.03
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	170	<7	<7	280
Chromium	µg/L	0.25	0.6	180	6.2	0.38	<0.25	<0.25	0.25	<0.25	0.26	6.7	0.66	0.75	1.2	<0.25	1.8	0.45	<0.25	0.3	0.44	2	10
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	µg/L	0.4	3.76	1130	6.4	4.4	11	<0.4	0.8	<0.4	-	<0.4	0.5	0.5	-	<0.4	1.8	<0.4	-	<0.4	<0.4	<0.4	-
Copper (Filtered)	µg/L	0.4	3.76	1130	-	-	-	-	-	-	<0.4	-	-	-	<0.4	-	-	-	<0.4	-	-	-	<0.4
Iron	µg/L	5.5	1000	300000	46	160	<5.5	230	170	260	-	82	14	68	-	280	38	590	-	410	480	1,200	-
Iron (Filtered)	µg/L	5.5	1000	300000	-	-	-	-	-	-	250	-	-	-	26	-	-	-	220	-	-	-	3,000
Lead	µg/L	0.09	1.3	390	4.2	<0.09	<0.09	4	<0.09	<0.09	-	4.1	<0.09	0.53	-	4.4	1	0.11	-	4	0.1	0.74	-
Lead (Filtered)	µg/L	0.09	1.3	390	-	-	-	-	-	-	0.1	-	-	-	0.2	-	-	-	<0.09	-	-	-	0.41
Mercury	µg/L	0.01	0.07	21	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	0.02	<0.01	0.07	-	0.02	0.04	0.02	-	0.05	0.02	0.07	-
Mercury (Filtered)	µg/L	0.01	0.07	21	-	-	-	-	-	-	<0.01	-	-	-	<0.01	-	-	-	<0.01	-	-	-	0.02
Nickel	µg/L	0.5	8.6	2580	5.9	2.4	0.7	0.8	1	0.6	-	1	1.7	0.7	-	0.8	2.5	<0.5	-	6.6	4.3	2.3	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	-	-	-	-	-	-	1	-	-	-	<0.5	-	-	-	1.2	-	-	-	8.8
Vanadium	µg/L	0.6	100	30000	0.8	-	-	0.7	-	-	-	1.4	-	-	-	<0.6	-	-	-	1.4	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1.3	7.9	2370	3.3	43	12	2.8	40	<1.3	-	1.6	33	4.5	-	1.5	57	2	-	10	46	3.5	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	-	-	-	-	-	-	8.4	-	-	-	2.9	-	-	-	2.5	-	-	-	11
Volatile and Semi Volatile Organic Compounds																								
1,2-dichloroethane	µg/L	1	10	3000	21	<1	<1	<1	<1	<1	<1	7	<1	8	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-dichloropropane	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1	2.5	749	<1	<1	26	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	10	<1	<1	<1	<1	<1
Phenol	µg/L	0.1	7.7	2310	<10	-	-	<1	-	-	0.21	1.6	-	-	0.69	<1	-	-	<0.1	1,300	<2	-	4,000
Phenols Monohydric	µg/L	100	7.7	2310	230	<100	110	<100	<100	<100	-	<100	<100	<100	-	<100	<100	<100	-	16,000	14,000	14,000	-
Aniline	µg/L	1	1.2	360	20	-	-	<1	-	-	<1	2.1	-	-	1.9	<1	-	-	<1	<100	<2	-	130
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	<10	-	-	<1	-	-	<1	<1	-	-	<1	<1	-	-	<1	<100	<2	-	<100
Other Inorganics																								
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	250	91	160	1.4	1	1.3	2.2	1.2	0.83	0.75	1.3	2.3	1.4	2.9	14	31	27	30	31
Cyanide Total	µg/L	0.1	1	300	60	300	190	290	350	300	120	<40	<40	<40	<40	<40	<40	<40	<40	570	690	<40	580
Thiocyanate (as SCN)	µg/L	20	9	2700	1,100	290	<20	<20	<20	<20	80	21	<20	<20	42	<20	<20	<20	<20	2,500	2,300	<20	2,800

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

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Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	South Bank Area B																						South Bank A
					BH-2001				BH-2004			BH-2006				BH-2009			SBB_AUK_BH101			SBB_AUK_BH102						SBB_AUK_B
	Well Installatior				A				A			A				A			D			D			S			D
	ample DateDat				16/02/2021	09/03/2021	03/08/2021		16/02/2021	09/03/2021	03/08/2021	16/02/2021	09/03/2021	03/08/2021		16/02/2021	09/03/2021	03/08/2021	12/07/2021	27/07/2021	29/07/2021	12/07/2021	27/07/2021	29/07/2021	12/07/2021	27/07/2021	29/07/2021	14/07/2021
Total Petroleum Hydrocarbons and Fuel Indicators																											
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	1.8	<1	<1	<1	1.1	<1	<1	<1	<1	<1	<1	1.4	<1	1.2	<1	<1	<1	<1	<1	<1
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	2	<1	<1	<1	1.3	<1	<1	<1	<1	<1	<1	3.4	<1	1	<1	<1	<1	<1	<1	<1	<1
>C16-C35 Aliphatics	µg/L		4.55	>SOL	<2	<2	<2	-	<2	<2	<2	-	<2	<2	-	<2	<2	-	-	-	-	-	-	-	-	-	-	-
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	8.1	9.3	11	4.3	<1	<1	<1	<1	<1	<1	<1
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	15	21	16	4.7	<1	<1	<1	<1	<1	<1	<1
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.1	4.9	8.8	4.7	<1	<1	<1	<1	<1	<1	<1
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	2.6	<1	<1	<1	<1	<1	<1	<1
Benzene	µg/L	1	8	2400	<1	<1	-	<1	<1	-	-	<1	-	-	<1	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	1	74	22200	<1	<1	-	<1	<1	-	-	<1	-	-	<1	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	1	20	5990	<1	<1	-	<1	<1	-	-	<1	-	-	<1	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylene Total	µg/L		30	8990	<3	<3	-	-	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons																											
Naphthalene	µg/L	0.05	2	599	0.27	3.2	0.47	0.06	1.1	1	1.1	0.52	1.9	1.9	0.57	7.3	5.7	5.1	<0.05	6.1	5.7	0.52	<0.05	0.56	0.24	0.14	0.06	<0.05
Fluoranthene	µg/L	0.01	0.0063	1.89	0.03	0.02	0.04	0.01	0.04	0.05	0.08	0.02	0.03	0.04	0.03	0.04	0.05	0.03	0.19	<0.01	0.03	0.03	<0.01	0.01	0.02	0.02	0.02	<0.01
Anthracene	µg/L	0.01	0.1	30	0.02	0.05	0.04	0.02	0.06	0.06	0.05	0.04	0.04	0.04	0.03	0.08	0.12	0.08	0.25	0.05	0.06	0.02	<0.01	<0.01	0.02	0.03	<0.01	<0.01
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Metals																											
Arsenic	µg/L	0.16	25	7490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	0.16	25	7490	2.4	2.8	3.9	2	2.1	1.6	1.5	2.3	3.1	2.7	1.3	2.2	2	2.5	4.2	3.3	3.8	1.7	0.72	0.7	1.7	2	1.9	2.4
Boron	µg/L	12	7000	2100000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (Filtered)	µg/L	12	7000	2100000	1,200	1,300	1,600	1,200	1,500	1,100	1,200	1,100	1,200	1,300	1,300	1,400	1,400	1,300	1,400	1,200	1,200	480	23	25	510	470	410	2,300
Cadmium	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.35	<0.03	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	<0.03	0.12
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	18	<7	<7	17	<7	<7	<7
Chromium	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.61	<0.25	<0.25	1.1	2.6	1.9	<0.25	2.5	0.45	6.6
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	µg/L	0.4	3.76	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (Filtered)	µg/L	0.4	3.76	1130	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	7.7	<0.4	<0.4	<0.4	1.1	6.1	4.2	0.4	<0.4	<0.4	0.8
Iron	µg/L	5.5	1000	300000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	5.5	1000	300000	-	-	-	70	-	-	-	23	-	-	10	-	-	240	130	49	38	28	130	48	51	20	28	1,900
Lead	µg/L	0.09	1.3	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Filtered)	µg/L	0.09	1.3	390	0.14	0.13	0.27	<0.09	<0.09	0.13	0.23	<0.09	0.3	0.42	<0.09	0.27	0.1	1.5	0.29	<0.09	<0.09	0.17	1.8	0.19	<0.09	0.15	<0.09	0.1
Mercury	µg/L	0.01	0.07	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (Filtered)	µg/L	0.01	0.07	21	0.01	<0.01	0.02	<0.01	0.03	<0.01	<0.01	0.01	0.02	<0.01	0.01	0.03	0.01	0.01	0.03	0.02	0.01	0.01	<0.01	<0.01	0.02	0.01	0.01	<0.01
Nickel	µg/L	0.5	8.6	2580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	1.3	1.6	1.3	1	1.1	<0.5	2.4	0.6	1.5	4.7	0.5	<0.5	<0.5	3.2	2.3	1.4	<0.5	1.5	2.8	2.8	3.4	1.4	2	1.4
Vanadium	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	2.9	3.2	0.8	0.6	<0.6	<0.6	<0.6	<0.6	0.7	<0.6	<0.6	0.7	<0.6	0.9	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1.3	7.9	2370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	<1.3	2.1	<1.3	<1.3	<1.3	<1.3	7.3	3.9	6.9	13	<1.3	2.6	<1.3	46	1.8	1.5	3.8	1.6	8.2	9.5	<1.3	<1.3	<1.3	2.1
Volatile and Semi Volatile Organic Compounds																											
1,2-dichloroethane	µg/L	1	10	3000	<1	<1	-	<1	<1	-	-	<1	-	-	<1	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-dichloropropane	µg/L	1	8	2400	<1	<1	-	<1	<1	-	-	<1	-	-	<1	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1	2.5	749	<1	<1	-	<1	<1	-	-	<1	-	-	<1	-	-	<1	<1	<1	<1	<1	19	22	<1	<1	<1	<1
Phenol	µg/L	0.1	7.7	2310	<0.1	<0.1	<0.1	0.62	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	0.15	<0.1	<0.1	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenols Monohydric	µg/L	100	7.7	2310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aniline	µg/L	1	1.2	360	<1	<1	-	<1	<1	-	-	<1	-	-	<1	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	<1	<1	-	<1	<1	-	-	<1	-	-	<1	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.1
Other Inorganics																											
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	2.6	2.6	8.5	4.1	6.5	8	7.7	5.3	150	20	17	12	14	13	12	11	7.9	6.2	0.28	0.82	5.2	8.7	7.4	53
Cyanide Total	µg/L	0.1	1	300	56	52	61	47	49	41	41	<40 - 14	82	81	86	47	47	76	120	120	100	150	<40	<40	65	66	73	190
Thiocyanate (as SCN)	µg/L	20	9	2700	-	-	-	5,500	-	-	-	17,000	-	-	60,000	-	-	22,000	62,000	77,000	140	33,000	1,800	3,700	4,100	22,000	<20	66,000

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

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Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	Area B														
					BH103		SBB_AUK_BH104					SBB_AUK_BH105				SBB_AUK_BH106			
							S		D			S	D			S	D		
Well Installation Sample Date		Dat			27/07/2021	29/07/2021	27/07/2021	29/07/2021	14/07/2021	27/07/2021	30/07/2021	14/07/2021	14/07/2021	27/07/2021	30/07/2021	27/07/2021	30/07/2021	14/07/2021	27/07/2021	30/07/2021
Total Petroleum Hydrocarbons and Fuel Indicators																			
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	1.9	<1	<1	<1	<1	<1	<1	<1	<1	<1
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	1	1.2	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	22	4.1	<1
>C16-C35 Aliphatics	µg/L		4.55	>SOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	31
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	21
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	9.5
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	16
Benzene	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	1	74	22200	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	3	2
Ethylbenzene	µg/L	1	20	5990	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylene Total	µg/L		30	8990	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons																			
Naphthalene	µg/L	0.05	2	599	0.16	0.95	0.28	0.13	0.34	<0.05	0.05	3.8	0.1	0.08	1.1	<0.05	<0.05	<0.05	<0.05	0.15
Fluoranthene	µg/L	0.01	0.0063	1.89	<0.01	<0.01	<0.01	<0.01	0.44	<0.01	0.01	4.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	µg/L	0.01	0.1	30	<0.01	<0.01	0.02	0.01	0.04	0.01	<0.01	<0.1	<0.01	0.02	<0.01	0.03	<0.01	<0.01	0.01	<0.01
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	<0.01	<0.01	<0.01	<0.01	0.25	<0.01	<0.01	2	<0.01	<0.01	<0.01	<0.01	<0.01	0.08	<0.01	<0.01
Metals																			
Arsenic	µg/L	0.16	25	7490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	0.16	25	7490	3.5	4.8	1.9	1.9	0.53	1.7	1.2	9.3	2.8	1.4	1.3	1.3	1.2	1.8	2.4	2.8
Boron	µg/L	12	7000	2100000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (Filtered)	µg/L	12	7000	2100000	1,800	1,900	2,100	2,000	900	53	610	12,000	13,000	12,000	3,600	13,000	12,000	720	1,100	1,200
Cadmium	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	0.06	<0.03	<0.03	0.05	<0.03	<0.03	0.08	0.04	0.12	<0.03	<0.03	<0.03	<0.03	0.07	0.12	0.19
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	17	<7	<7	<7	<7	<7	<7	<7	<7
Chromium	µg/L	0.25	0.6	180	0.66	0.42	1.2	0.6	6.9	2.6	<0.25	160	0.91	1.1	0.56	6.2	0.65	2.2	<0.25	0.8
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	µg/L	0.4	3.76	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (Filtered)	µg/L	0.4	3.76	1130	1	<0.4	1.6	3.1	<0.4	0.8	1.8	1.6	0.9	2	<0.4	1.3	0.8	2.4	18	17
Iron	µg/L	5.5	1000	300000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	5.5	1000	300000	2,100	7,700	150	130	510	16	750	1,100	110	88	1,300	91	84	740	280	1,100
Lead	µg/L	0.09	1.3	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Filtered)	µg/L	0.09	1.3	390	0.66	<0.09	0.52	0.64	<0.09	0.13	3.5	1.3	0.16	0.11	0.27	0.29	0.25	1.1	1.9	0.8
Mercury	µg/L	0.01	0.07	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (Filtered)	µg/L	0.01	0.07	21	0.02	<0.01	0.01	0.02	0.01	0.02	<0.01	0.03	0.04	0.04	0.02	0.02	0.04	0.03	<0.01	<0.01
Nickel	µg/L	0.5	8.6	2580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	2.7	1.3	3.1	3	1.4	2.1	3.1	1.9	7.2	4.9	4.4	1.8	1.5	8.9	9.2	55
Vanadium	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1.3	7.9	2370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	3.2	13	6	6.4	2.7	3.7	17	7.6	3.8	2.9	3.7	2.6	3.3	15	1.9	<1.3
Volatile and Semi Volatile Organic Compounds																			
1,2-dichloroethane	µg/L	1	10	3000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-dichloropropane	µg/L	1	8	2400	<1	13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1	2.5	749	<1	<1	<1	<1	<1	22	2	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenol	µg/L	0.1	7.7	2310	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenols Monohydric	µg/L	100	7.7	2310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aniline	µg/L	1	1.2	360	<1	<1	<1	<1	<2	<1	<1	<2	<1	<1	<1	<1	<1	<1	2.8	<1
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	1.2	<1	<1	<1	<2	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	<1
Other Inorganics																			
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	44	88	6.1	5.9	3.5	0.72	<0.015	7	<0.015	0.49	2.4	0.2	0.25	18	<0.015	0.61
Cyanide Total	µg/L	0.1	1	300	140	180	58	69	57	<40	71	260	160	94	190	<40	43	280	1,200	3,800
Thiocyanate (as SCN)	µg/L	20	9	2700	86,000	120	4,200	5,400	11,000	<20	140,000	120,000	45,000	21,000	270,000	250	630	490,000	1,700,000	1,000,000

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

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Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	South Bank Area B																			
					SBB_AUK_BH107						SBB_AUK_BH108			SBB_AUK_BH109					SBB_XXX_BH204A			SBB_XXX_BH205	
	Well Installatior				D			S			D			D			S		A			A	
	Sample Date	Dat			12/07/2021	27/07/2021	29/07/2021	12/07/2021	27/07/2021	29/07/2021	14/07/2021	27/07/2021	29/07/2021	14/07/2021	27/07/2021	29/07/2021	27/07/2021	29/07/2021	14/07/2021	27/07/2021	30/07/2021	27/07/2021	29/07/2021
Total Petroleum Hydrocarbons and Fuel Indicators																								
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	6	<1	<1	1.5	<1	<1	<1	3.2	<1	<1	<1	<1	2	
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	13	<1	<1	6.3	<1	<1	<1	1.5	<1	<1	<1	<1	1.8	
>C16-C35 Aliphatics	µg/L		4.55	>SOL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	18	<1	4.8	
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	14	<1	7.5	
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	9.3	<1	19	
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	12	<1	7.1	
Benzene	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Toluene	µg/L	1	74	22200	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Ethylbenzene	µg/L	1	20	5990	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Xylene Total	µg/L		30	8990	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Polycyclic Aromatic Hydrocarbons																								
Naphthalene	µg/L	0.05	2	599	0.34	<0.5	0.07	1	0.07	0.57	<0.05	0.1	0.08	0.08	0.12	<0.05	<0.05	1.1	0.31	0.18	0.05	0.07	1.8	
Fluoranthene	µg/L	0.01	0.0063	1.89	0.04	0.01	<0.01	0.03	0.03	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.07	<0.01	<0.01	<0.01	0.01	
Anthracene	µg/L	0.01	0.1	30	0.02	0.02	<0.01	0.02	0.02	0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	0.02	<0.01	0.02	0.01	
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	0.02	<0.01	<0.01	<0.01	0.02	<0.01	0.08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.11	<0.01	<0.01	<0.01	<0.01	
Metals																								
Arsenic	µg/L	0.16	25	7490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arsenic (Filtered)	µg/L	0.16	25	7490	2.4	2.5	2.4	2.5	2.7	2.6	4.3	3.7	3.6	1.3	1.1	0.69	1.4	1.4	1.8	1.4	1.4	2.1	2.1	
Boron	µg/L	12	7000	2100000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Boron (Filtered)	µg/L	12	7000	2100000	2,200	2,100	2,000	1,900	1,800	1,700	1,700	1,600	1,500	2,700	3,900	2,000	6,700	7,300	1,400	930	1,800	9,600	9,900	
Cadmium	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	<0.03	<0.03	0.07	<0.03	<0.03	<0.03	0.08	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	
Chromium	µg/L	0.25	0.6	180	0.47	0.85	0.56	7.9	0.77	0.28	4.9	0.59	0.67	1.4	<0.25	0.6	0.46	0.37	4.8	1.8	1.2	0.45	0.72	
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Copper	µg/L	0.4	3.76	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Copper (Filtered)	µg/L	0.4	3.76	1130	0.5	1	0.7	0.4	<0.4	<0.4	0.9	<0.4	<0.4	<0.4	<0.4	1.2	<0.4	0.5	<0.4	0.7	<0.4	<0.4	<0.4	
Iron	µg/L	5.5	1000	300000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Iron (Filtered)	µg/L	5.5	1000	300000	79	21	41	36	18	15	230	740	470	94	29	830	18	49	4,600	1,000	5,400	60	22	
Lead	µg/L	0.09	1.3	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Lead (Filtered)	µg/L	0.09	1.3	390	0.11	0.23	0.17	0.12	<0.09	<0.09	0.43	0.4	<0.09	0.12	0.13	0.31	<0.09	0.12	<0.09	0.41	<0.09	0.11	<0.09	
Mercury	µg/L	0.01	0.07	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Mercury (Filtered)	µg/L	0.01	0.07	21	0.09	0.05	0.06	0.1	0.08	0.08	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.02	
Nickel	µg/L	0.5	8.6	2580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Nickel (Filtered)	µg/L	0.5	8.6	2580	1.2	1.7	2.3	1.6	1.4	2	2.2	2.2	2.1	1.4	0.7	2.5	0.5	1	2.6	6.7	2.4	4.4	4.2	
Vanadium	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Vanadium (Filtered)	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Zinc	µg/L	1.3	7.9	2370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Zinc (Filtered)	µg/L	1.3	7.9	2370	1.4	1.8	1.5	2.2	2	13	7.8	5.7	1.9	2.9	2.2	2.8	<1.3	3.4	2.9	8.5	2	1.4	<1.3	
Volatile and Semi Volatile Organic Compounds																								
1,2-dichloroethane	µg/L	1	10	3000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
1,2-dichloropropane	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Chloroform	µg/L	1	2.5	749	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Phenol	µg/L	0.1	7.7	2310	<0.1	<0.1	<0.1	<0.1	0.16	<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Phenols Monohydric	µg/L	100	7.7	2310	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Aniline	µg/L	1	1.2	360	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.6	<1	<1	<1	<2	<1	<1	<1	1.4	
Other Inorganics																								
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	0.87	0.7	0.4	1	0.75	0.5	22	21	22	2.5	0.79	1.9	0.13	<0.015	4.7	1.8	7.5	0.82	0.44	
Cyanide Total	µg/L	0.1	1	300	<40	49	<40	<40	<40	<40	150	130	140	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	
Thiocyanate (as SCN)	µg/L	20	9	2700	93	120	99	180	150	200	35,000	36,000	<20	820	170	110	<20	41	25	140	520	300	430	

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

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Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	South Bank Area C																			
					SBC_AUK_BH101						SBC_AUK_BH102						SBC_AUK_BH103						SBC_AUK_BH104	
Well Installation					D			S			D			S			D			S			D	
Sample Date					21/06/2021	08/07/2021	20/07/2021	21/06/2021	08/07/2021	20/07/2021	23/06/2021	09/07/2021	20/07/2021	23/06/2021	09/07/2021	20/07/2021	18/06/2021	08/07/2021	22/07/2021	23/06/2021	08/07/2021	22/07/2021	09/07/2021	22/07/2021
Total Petroleum Hydrocarbons and Fuel Indicators																								
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	3.4	<1	<1	<1	<1	<1	6	23	<1	<1	<1	4.9	<1
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	1.3	<1	<1	1.4	<1	<1	5.5	<1	<1	<1	<1	<1	2.8	7.8	<1	<1	<1	7.6	<1
>C16-C35 Aliphatics	µg/L		4.55	>SOL	<2	-	-	<2	-	-	<2	-	-	<2	-	-	<2	-	-	<2	-	-	-	-
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	26	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	<1	39	<1	<1	<1	<1	<1	<1	<1	<1	8.6	<1	7.9	<1	1.8	<1	<1	<1	3.5	<1
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	<1	34	<1	<1	<1	<1	<1	<1	<1	<1	18	<1	12	<1	7.3	<1	<1	<1	5.3	<1
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	<1	1.3	<1	<1	<1	<1	<1	<1	<1	<1	46	<1	1.4	<1	<1	<1	<1	<1	14	<1
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	42	<1	<1	<1	<1	<1	<1	<1	2.5	<1
Benzene	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	1	74	22200	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	1	20	5990	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylene Total	µg/L		30	8990	<3	-	-	<3	-	-	<3	-	-	<3	-	-	<3	-	-	<3	-	-	-	-
Polycyclic Aromatic Hydrocarbons																								
Naphthalene	µg/L	0.05	2	599	<0.1	11	0.07	2.7	5.9	0.08	<0.05	0.31	<0.05	<0.05	0.1	<0.05	0.23	13	<5	<0.05	0.79	2.6	0.09	<0.05
Fluoranthene	µg/L	0.01	0.0063	1.89	0.22	0.03	0.02	1.3	0.01	<0.01	0.05	0.62	<0.01	0.01	0.02	<0.01	0.06	0.02	0.03	0.03	0.01	<0.01	0.02	0.01
Anthracene	µg/L	0.01	0.1	30	<0.1	0.06	0.02	0.37	0.02	0.02	<0.01	0.08	0.02	<0.01	0.06	0.02	0.11	0.03	0.05	0.04	0.01	0.02	0.01	0.02
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	0.19	<0.01	<0.01	0.58	<0.01	<0.01	0.01	0.43	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Metals																								
Arsenic	µg/L	0.16	25	7490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	0.16	25	7490	1.1	0.87	1.2	2	0.89	2.4	1.7	2.4	1.3	2.7	3.1	2.3	0.62	0.82	0.77	0.6	0.66	0.7	1.9	5.3
Boron	µg/L	12	7000	2100000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (Filtered)	µg/L	12	7000	2100000	550	590	530	420	460	460	340	430	420	390	460	430	190	410	170	280	400	440	7,300	9,900
Cadmium	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	0.09	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	<0.03	<0.03	<0.03	<0.03
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7
Chromium	µg/L	0.25	0.6	180	-	2.4	1.5	-	1.2	0.93	-	23	86	-	1.8	54	0.73	2.9	<0.25	-	1.8	1.1	46	<0.25
Chromium (Filtered)	µg/L	0.25	0.6	180	1.1	-	-	<0.25	-	-	4.8	-	-	0.57	-	-	<0.25	-	-	0.48	-	-	-	-
Copper	µg/L	0.4	3.76	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (Filtered)	µg/L	0.4	3.76	1130	1	<0.4	5.3	0.8	<0.4	5.8	2.6	0.6	9.5	0.7	1.1	9.7	0.4	0.8	<0.4	1	<0.4	0.6	<0.4	<0.4
Iron	µg/L	5.5	1000	300000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	5.5	1000	300000	330	400	960	940	55	1,600	240	130	270	82	110	210	6.4	210	120	290	97	100	170	61
Lead	µg/L	0.09	1.3	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Filtered)	µg/L	0.09	1.3	390	0.74	<0.09	0.13	5.8	0.09	<0.09	1.4	0.11	1.8	0.11	<0.09	0.48	1.4	1	1.5	1.5	<0.09	0.25	<0.09	<0.09
Mercury	µg/L	0.01	0.07	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (Filtered)	µg/L	0.01	0.07	21	0.03	<0.01	<0.01	0.01	<0.01	<0.01	0.26	0.11	0.03	0.12	0.1	0.07	0.04	0.02	<0.01	0.02	0.02	<0.01	0.13	0.12
Nickel	µg/L	0.5	8.6	2580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	2.4	2.1	1.8	<0.5	1	1.3	2.7	2.6	5.3	1.7	1.5	2.1	1.4	2	2.2	3.5	1.8	2.4	4.6	1.1
Vanadium	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1.3	7.9	2370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	6.6	2.6	6.7	10	5.6	5.1	12	4.1	29	3.2	2.1	14	2.2	11	7.1	13	8.3	3.7	<1.3	13
Volatile and Semi Volatile Organic Compounds																								
1,2-dichloroethane	µg/L	1	10	3000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-dichloropropane	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1	2.5	749	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenol	µg/L	0.1	7.7	2310	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.24	<0.1	<0.1	<0.1	0.13	<0.1	<0.1
Phenols Monohydric	µg/L	100	7.7	2310	<100	-	-	<100	-	-	<100	-	-	<100	-	-	<100	-	-	<100	-	-	-	-
Aniline	µg/L	1	1.2	360	<1	<2	<1	<1	<2	<1	<1	<10	<2	<1	<1	<2.5	<1	<2	<1	<1	<2	<1	<1	<1
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	<1	4.5	<1	<1	3.3	<1	<1	12	<2	<1	<1	<2.5	<1	<2	<1	<1	<2	<1	5.3	1
Other Inorganics																								
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	0.25	0.84	0.21	0.82	0.89	0.48	0.59	0.6	0.7	0.44	0.44	0.67	0.49	8.1	0.17	0.6	0.91	0.9	1.9	0.21
Cyanide Total	µg/L	0.1	1	300	<40	<40	<40	<40	<40	<40	94	140	140	150	76	160	<40	<40	<40	<40	<40	<40	<40	44
Thiocyanate (as SCN)	µg/L	20	9	2700	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	31	23	<20	83	<20	<20	<20	<20	53

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

ARCADIS

Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	South Bank Area C																					South Bank A
					SBC_AUK_BH105			SBC_AUK_BH106						SBC_AUK_BH107						SBC_AUK_BH108						SBC_AUK_B
	Well Installatior				A			D			S			D			S			D			S			D
	Sample Date	Dat			17/06/2021	07/07/2021	20/07/2021	18/06/2021	08/07/2021	22/07/2021	18/06/2021	08/07/2021	22/07/2021	17/06/2021	08/07/2021	22/07/2021	22/06/2021	08/07/2021	22/07/2021	17/06/2021	07/07/2021	21/07/2021	17/06/2021	07/07/2021	21/07/2021	23/06/2021
Total Petroleum Hydrocarbons and Fuel Indicators																										
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	13	4.1	<0.1	<0.1	<0.1	4.5	140	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	2.2	<1	<1	<1	2	<1	7.1	<1	<1	1.2	<1	<1	<1	7.6	<1	2.1	2.7	<1	1.1	<1	<1	<1
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	1.3	<1	4.8	<1	<1	2	2.8	<1	<1	6.3	<1	2.1	5.5	<1	<1	<1	<1	<1
>C16-C35 Aliphatics	µg/L		4.55	>SOL	63	-	-	144	-	-	102	-	-	114	-	-	<2	-	-	84.5	-	-	23.1	-	-	<2
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	110	100	62	<0.1	<0.1	<0.1	300	320	320	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	15	<1	<1	<1	2.4	<1	4,200	970	260	34	<1	<1	<1	1,200	4,000	38	<1	<1	28	<1	<1	<1
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	14	<1	<1	<1	3.4	<1	2,500	470	170	26	<1	<1	<1	640	2,100	32	<1	<1	24	<1	<1	<1
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	31	<1	<1	7.3	12	<1	88	17	3.9	66	<1	<1	<1	30	41	63	<1	<1	32	<1	<1	<1
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	22	<1	<1	18	2.2	<1	23	<1	<1	38	<1	<1	<1	1.9	<1	40	<1	<1	21	<1	<1	<1
Benzene	µg/L	1	8	2400	<1	<1	<1	2	<1	<1	790	900	2,000	45	30	42	1,800	1,700	2,100	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	1	74	22200	<1	<1	<1	<1	<1	<1	6	8	3	5	3	4	260	180	270	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	1	20	5990	<1	<1	<1	<1	<1	<1	4	3	2	<1	<1	<1	15	15	16	<1	<1	<1	<1	<1	<1	<1
Xylene Total	µg/L		30	8990	<3	-	-	<3	-	-	47	-	-	<3	-	-	192	-	-	<3	-	-	<3	-	-	<3
Polycyclic Aromatic Hydrocarbons																										
Naphthalene	µg/L	0.05	2	599	<0.05	<0.05	0.17	<0.5	0.3	2	<5	370	210	20	9	13	6,000	2,300	4,800	0.05	0.07	<0.05	0.31	0.3	<0.05	<0.05
Fluoranthene	µg/L	0.01	0.0063	1.89	<0.01	0.02	<0.01	0.01	0.01	<0.01	0.64	0.22	0.1	<0.01	0.03	0.02	2.8	0.94	0.83	<0.01	0.04	0.03	0.01	0.08	0.02	0.02
Anthracene	µg/L	0.01	0.1	30	0.04	0.04	0.07	0.02	0.01	0.02	<1	4	0.51	<0.01	0.03	0.03	4.7	1.4	4.7	<0.01	<0.01	0.02	<0.01	0.16	0.05	<0.01
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	0.11	<0.01
Metals																										
Arsenic	µg/L	0.16	25	7490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	0.16	25	7490	4.8	9.4	15	0.71	0.69	0.47	2.6	3.7	3.3	0.74	0.79	0.98	6.5	3.1	1.6	0.35	0.39	0.45	0.32	6	5.4	0.52
Boron	µg/L	12	7000	2100000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (Filtered)	µg/L	12	7000	2100000	18,000	19,000	22,000	400	470	220	500	630	520	420	460	420	290	300	270	250	190	290	240	20,000	26,000	260
Cadmium	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	0.04	<0.03	0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.12	0.05	0.1	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	22	<7	<7	<7	<7	<7	<7	<7	<7	<7
Chromium	µg/L	0.25	0.6	180	5.8	25	24	2.5	0.71	0.32	10	11	6.5	<0.25	0.37	2.7	4.3	7.8	18	<0.25	15	4.5	0.27	23	8.6	-
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	<0.25	-	-	0.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.51
Copper	µg/L	0.4	3.76	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (Filtered)	µg/L	0.4	3.76	1130	1.7	0.5	3.2	2.2	1.8	0.6	0.9	2.3	1.9	<0.4	<0.4	<0.4	1.2	<0.4	0.7	0.5	0.9	6.5	0.7	0.5	4.6	0.6
Iron	µg/L	5.5	1000	300000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	5.5	1000	300000	150	120	990	24	22	34	130	140	210	45	29	54	1,800	1,600	2,200	470	34	980	130	47	210	92
Lead	µg/L	0.09	1.3	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Filtered)	µg/L	0.09	1.3	390	0.73	0.51	5.6	0.52	0.15	0.35	0.2	<0.09	0.24	<0.09	<0.09	0.11	1.2	0.3	1.2	0.3	<0.09	0.48	0.14	0.23	0.19	0.26
Mercury	µg/L	0.01	0.07	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (Filtered)	µg/L	0.01	0.07	21	0.01	0.02	0.02	0.21	0.23	0.06	0.08	0.06	0.08	0.43	0.41	0.36	0.12	0.06	0.05	0.02	<0.01	0.01	0.05	0.09	0.08	0.21
Nickel	µg/L	0.5	8.6	2580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	1.9	2.5	1.7	1.7	2.3	1.6	1.5	1.5	1.7	2.7	2.1	3.8	19	12	15	1.2	2.3	2	1.7	2.5	1.3	1.3
Vanadium	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1.3	7.9	2370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	10	3.9	25	1.6	9.7	4.1	<1.3	1.4	1.6	2	1.5	2.7	12	39	73	5.2	18	17	5.5	8.5	2.3	12
Volatile and Semi Volatile Organic Compounds																										
1,2-dichloroethane	µg/L	1	10	3000	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-dichloropropane	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1	2.5	749	<1	<1	<1	<1	<1	<1	3	3	2	<1	<1	<1	5	4	5	<1	11	3	<1	<1	<1	<1
Phenol	µg/L	0.1	7.7	2310	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.23	1.6	1.1	3.1	27	<1	360	990	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1
Phenols Monohydric	µg/L	100	7.7	2310	-	-	-	<100	-	-	<100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<100
Aniline	µg/L	1	1.2	360	<1	<2	<2.5	<1	<2	<1	4.4	<10	2.9	<1	<1	<2	<5	<2	<2	<1	<1	<1	<1	<5	<1	<1
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	<1	<2	<2.5	<1	<2	<1	<1	<10	<1	<1	<1	<2	<5	<2	<2	<1	<1	<1	<1	<5	1.1	<1
Other Inorganics																										
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	0.08	0.52	0.54	0.64	1	<0.015	21	24	19	5.5	5.2	5.9	360	290	<0.015	0.34	0.11	0.16	0.51	0.3	0.27	0.7
Cyanide Total	µg/L	0.1	1	300	89	67	81	<40	<40	<40	190	250	190	<40	<40	<40	500	1,400	900	<40	<40	<40	<40	<40	<40	<40
Thiocyanate (as SCN)	µg/L	20	9	2700	<20	<20	34	<20	<20	<20	46	<20	55	130	<20	150	9,500	<20	7,500	<20	<20	<20	<20	<20	<20	23

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

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Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	Area C															
					BH109					SBC_AUK_BH110		SBC_AUK_BH112					SBC_AUK_BH113			SBC_AUK_BH114
	Well Installation						S			A		D			S		A			A
	Sample Date	Dat			07/07/2021	22/07/2021	17/06/2021	07/07/2021	22/07/2021	09/07/2021	22/07/2021	18/06/2021	08/07/2021	22/07/2021	08/07/2021	22/07/2021	18/06/2021	09/07/2021	21/07/2021	18/06/2021
Total Petroleum Hydrocarbons and Fuel Indicators																				
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1	<1	2.5	<1	<1	<1	6.2	<1	<1	<1
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	2.5	<1	<1	<1	<1	1.8	<1	2.5	<1	39	<1	<1	<1
>C16-C35 Aliphatics	µg/L		4.55	>SOL	-	-	<2	-	-	-	-	<2	-	-	-	-	22	-	-	3.5
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3.6	<0.1	<0.1
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	<1	<1	15	15	<1	<1	<1	<1	6.2	25	12	<1	9	<1	<1	33
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	<1	<1	21	63	<1	<1	<1	<1	57	94	72	<1	110	<1	<1	36
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	<1	<1	7.5	<1	<1	<1	<1	<1	30	<1	20	<1	4.6	<1	<1	<1
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	<1	<1	6.1	<1	<1	<1	<1	<1	3.7	<1	<1	<1	<1	<1	<1	<1
Benzene	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	1	74	22200	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	1	20	5990	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylene Total	µg/L		30	8990	-	-	<3	-	-	-	-	<3	-	-	-	-	6	-	-	3
Polycyclic Aromatic Hydrocarbons																				
Naphthalene	µg/L	0.05	2	599	<0.05	<0.05	<0.05	<5	0.05	0.06	0.08	<0.05	0.15	13	0.17	0.13	<5	<0.05	<0.05	0.08
Fluoranthene	µg/L	0.01	0.0063	1.89	<0.01	<0.01	<0.01	0.04	0.01	0.06	0.04	0.07	0.05	0.04	0.1	0.05	0.09	0.02	0.06	<0.01
Anthracene	µg/L	0.01	0.1	30	<0.01	<0.01	0.02	0.07	0.05	0.02	0.1	0.02	0.08	0.06	0.14	0.09	0.54	0.03	0.57	0.02
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Metals																				
Arsenic	µg/L	0.16	25	7490	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	0.16	25	7490	0.44	0.59	2.6	2.3	3.1	3.4	3.4	0.49	0.49	0.57	0.87	0.81	2.1	3.1	4	1.1
Boron	µg/L	12	7000	2100000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (Filtered)	µg/L	12	7000	2100000	65	95	20,000	24,000	27,000	2,200	2,100	270	370	320	470	470	520	650	690	860
Cadmium	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	0.08	<0.03
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	15	15	10	18	<7
Chromium	µg/L	0.25	0.6	180	3.3	7.5	<0.25	72	0.38	59	19	2.1	1.1	0.89	4.4	7.8	<0.25	0.57	1.2	<0.25
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	-	-	-	-	<0.25	-	-	-	-	0.25	-	-	0.82
Copper	µg/L	0.4	3.76	1130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper (Filtered)	µg/L	0.4	3.76	1130	0.8	2.2	0.5	<0.4	1.9	<0.4	<0.4	0.6	0.8	<0.4	1.1	3	0.8	<0.4	4.2	1.7
Iron	µg/L	5.5	1000	300000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	5.5	1000	300000	130	140	100	66	73	110	89	110	95	720	190	230	57	55	550	380
Lead	µg/L	0.09	1.3	390	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead (Filtered)	µg/L	0.09	1.3	390	0.13	1.1	0.71	<0.09	0.12	<0.09	<0.09	0.29	0.15	0.15	<0.09	<0.09	0.3	<0.09	1.4	0.58
Mercury	µg/L	0.01	0.07	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury (Filtered)	µg/L	0.01	0.07	21	<0.01	0.01	0.03	0.04	0.01	0.15	0.14	0.1	0.13	0.02	0.06	0.06	<0.01	<0.01	0.01	<0.01
Nickel	µg/L	0.5	8.6	2580	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	1	1.5	1.7	2.9	1.6	1.9	2.6	2.8	3.5	2.8	3	3.3	1.2	1	1.4	4.4
Vanadium	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	µg/L	1.3	7.9	2370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	2.1	5.6	7.7	2.4	5.5	1.7	<1.3	4.5	7.1	2.6	<1.3	1.6	<1.3	<1.3	11	6.6
Volatile and Semi Volatile Organic Compounds																				
1,2-dichloroethane	µg/L	1	10	3000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-dichloropropane	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1	2.5	749	30	21	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	1	2	<1
Phenol	µg/L	0.1	7.7	2310	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.16	0.72	<0.1	<0.1	<0.1	<0.1
Phenols Monohydric	µg/L	100	7.7	2310	-	-	-	-	-	-	-	<100	-	-	-	-	<100	-	-	280
Aniline	µg/L	1	1.2	360	<1	<1	<1	<1	<1	<1	<2	<1	<2	<1	<2	<1	<1	<1	<1	<1
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	<1	<1	<1	<1	<1	<1	2.9	<1	<2	<1	<2	<1	<1	1.4	<1	<1
Other Inorganics																				
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	0.14	<0.015	0.05	0.079	<0.015	0.099	<0.015	0.75	1.7	0.68	3.8	3.8	24	26	30	210
Cyanide Total	µg/L	0.1	1	300	<40	<40	41	46	54	<40	94	<40	<40	<40	310	420	64	<40	87	70
Thiocyanate (as SCN)	µg/L	20	9	2700	<20	<20	<20	<20	<20	<20	<20	26	<20	<20	<20	51	21	<20	<20	4,400

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

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Redcar South Bank

Table 3: Comparison of Measured Groundwater Concentrations with EQS and SSAC

Compound	Units	MDL	Adopted Saline EQS	Water Resources SSAC (with dilution)	South Bank Area C						
					SBC_AUK_BH115				SBC_AUK_BH116		
Well Installation					A				A		
Sample Date	Dat				17/06/2021	07/07/2021	08/07/2021	21/07/2021	17/06/2021	08/07/2021	21/07/2021
Total Petroleum Hydrocarbons and Fuel Indicators											
>C5-C6 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C6-C8 Aliphatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C8-C10 Aliphatics	µg/L	0.1	4.55	>SOL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>C10-C12 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1
>C12-C16 Aliphatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	<1	<1	<1
>C16-C35 Aliphatics	µg/L		4.55	>SOL	<2	-	-	-	<2	-	-
>EC8-EC10 Aromatics	µg/L	0.1	4.55	1360	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
>EC10-EC12 Aromatics	µg/L	1	4.55	1360	<1	<1	<1	<1	9.1	<1	<1
>EC12-EC16 Aromatics	µg/L	1	4.55	1360	<1	<1	<1	<1	190	26	<1
>EC16-EC21 Aromatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	6.3	<1	<1
>EC21-EC35 Aromatics	µg/L	1	4.55	>SOL	<1	<1	<1	<1	1.3	<1	<1
Benzene	µg/L	1	8	2400	4	<1	<1	<1	<1	<1	<1
Toluene	µg/L	1	74	22200	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	1	20	5990	<1	<1	<1	<1	<1	<1	<1
Xylene Total	µg/L		30	8990	<3	-	-	-	5	-	-
Polycyclic Aromatic Hydrocarbons											
Naphthalene	µg/L	0.05	2	599	0.97	1.1	1.1	20	<0.05	0.09	<0.05
Fluoranthene	µg/L	0.01	0.0063	1.89	<0.01	0.01	<0.01	<1	0.12	0.13	0.03
Anthracene	µg/L	0.01	0.1	30	<0.01	0.03	<0.01	1.6	0.49	0.27	0.13
Benzo(a)pyrene	µg/L	0.01	0.00017	0.0509	<0.01	<0.01	<0.01	<1	<0.01	<0.01	<0.01
Metals											
Arsenic	µg/L	0.16	25	7490	-	-	-	-	-	-	-
Arsenic (Filtered)	µg/L	0.16	25	7490	14	2.6	5.5	4.5	9.2	13	17
Boron	µg/L	12	7000	2100000	-	-	-	-	-	-	-
Boron (Filtered)	µg/L	12	7000	2100000	42,000	16,000	15,000	57,000	10,000	7,500	12,000
Cadmium	µg/L	0.03	0.2	59.9	-	-	-	-	-	-	-
Cadmium (Filtered)	µg/L	0.03	0.2	59.9	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Chromium (hexavalent)	µg/L	7	0.6	180	<7	<7	<7	<7	<7	<7	<7
Chromium	µg/L	0.25	0.6	180	0.41	5.8	71	3.8	0.3	1.8	0.36
Chromium (Filtered)	µg/L	0.25	0.6	180	-	-	-	-	-	-	-
Copper	µg/L	0.4	3.76	1130	-	-	-	-	-	-	-
Copper (Filtered)	µg/L	0.4	3.76	1130	<0.4	<0.4	<0.4	5.2	<0.4	0.8	1.8
Iron	µg/L	5.5	1000	300000	-	-	-	-	-	-	-
Iron (Filtered)	µg/L	5.5	1000	300000	80	180	290	97	580	81	630
Lead	µg/L	0.09	1.3	390	-	-	-	-	-	-	-
Lead (Filtered)	µg/L	0.09	1.3	390	0.14	1.2	0.26	0.15	<0.09	0.12	0.32
Mercury	µg/L	0.01	0.07	21	-	-	-	-	-	-	-
Mercury (Filtered)	µg/L	0.01	0.07	21	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Nickel	µg/L	0.5	8.6	2580	-	-	-	-	-	-	-
Nickel (Filtered)	µg/L	0.5	8.6	2580	2.8	2.8	1.5	2.7	4.1	2.1	1.7
Vanadium	µg/L	0.6	100	30000	-	-	-	-	-	-	-
Vanadium (Filtered)	µg/L	0.6	100	30000	-	-	-	-	-	-	-
Zinc	µg/L	1.3	7.9	2370	-	-	-	-	-	-	-
Zinc (Filtered)	µg/L	1.3	7.9	2370	2.9	18	23	2.1	3.2	8.9	4.8
Volatile and Semi Volatile Organic Compounds											
1,2-dichloroethane	µg/L	1	10	3000	<1	<1	<1	<1	<1	<1	<1
1,2-dichloropropane	µg/L	1	8	2400	<1	<1	<1	<1	<1	<1	<1
Chloroform	µg/L	1	2.5	749	<1	<1	<1	<1	<1	<1	<1
Phenol	µg/L	0.1	7.7	2310	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1
Phenols Monohydric	µg/L	100	7.7	2310	-	-	-	-	-	-	-
Aniline	µg/L	1	1.2	360	<1	<5	<10	<5	<1	<1	1.1
Bis(2-ethylhexyl) phthalate	µg/L	1	1.3	>SOL	<1	<5	<10	<5	<1	<1	<1
Other Inorganics											
Ammoniacal Nitrogen as N	mg/L	0.015	0.021	6.29	0.37	8.2	2.4	2.9	0.05	2.1	0.64
Cyanide Total	µg/L	0.1	1	300	44	<40	<40	<40	200	130	150
Thiocyanate (as SCN)	µg/L	20	9	2700	<20	<20	<20	28	<20	<20	22

Notes

-	Not Analysed
x.xx	Concentration exceeds EQS
x.xx	Concentration exceeds SSAC and EQS
EQS	Environmental Quality Standard
SSAC	Site Specific Assessment Criteria
S	Denotes shallow well installation
D	Denotes deeper well installation

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Appendix A

Study Limitations

IMPORTANT. This appendix 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) Limited ('Arcadis'), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with South Tees Development Corporation (UK) Limited (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. otherwise in writing. The contents of this report may not be used or relied upon by any person other than this party without the express written consent and authorisation of Arcadis.

3 Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Arcadis is 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 has 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. provided by third parties. Arcadis has taken reasonable steps to ensure that the information sources used for this assessment provided accurate information, and has therefore assumed this to be the case.

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 inspection. 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, safe location of exploratory holes has been carried out with reference to the Arcadis ground disturbances procedure. 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 issues.

13 Unless otherwise stated, an inspection of the site has not been undertaken and there may be conditions present at the site which have not been identified within the scope of this assessment.

14 Unless otherwise stated, samples from the site (soil, groundwater, building fabric or other samples) have not been obtained.

15 Arcadis has relied upon the accuracy of documents, oral information and other material and information provided by the Client and others, and Arcadis assumes no liability for the accuracy of such data, although in the event of apparent conflicts in information, Arcadis would highlight this and seek to resolve.

16 Unless otherwise stated, the scope of works has not included an environmental compliance review, health and safety compliance review, hazardous building materials assessment, interviews or contacting Local Authority, requests for information to the petroleum officer, sampling or analyses of soil, ground water, surface water, air or hazardous building materials or a chain of title review.

17 Unless otherwise stated, this assessment has considered the ongoing use of the site and has not been prepared for the purposes of redevelopment which may act as a trigger for site investigation and remediation works not needed for ongoing use.

Appendix B

Sensitivity Assessment

Appendix B

Sensitivity Testing

To account for the inherent uncertainty present when simplifying the environment for modelling purposes, a range of values was specified for each parameter adopted within the assessment. The dilution calculation model is set up using a value from each of the ranges; this value is not necessarily the final chosen value.

Each parameter is modified, one at a time, whilst maintaining the remaining parameters at the starting values to identify which parameters have the greatest effect on the site model.

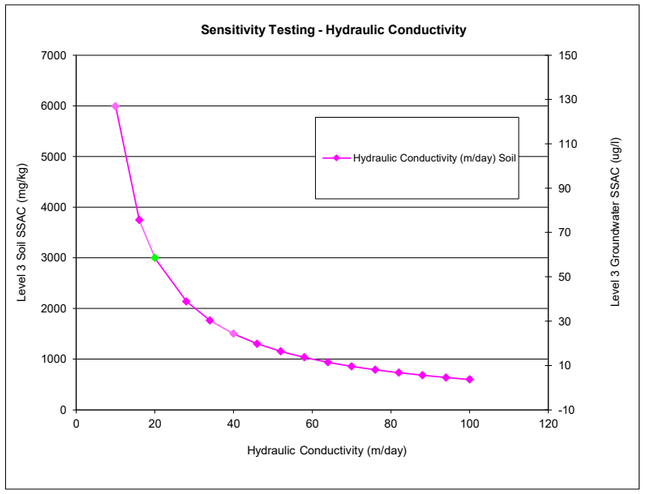
The process is repeated to ensure the parameters selected are appropriate for the site conditions. The physical input value selection and sensitivity of each parameter are presented on the following sheet.

Redcar South Bank

Appendix B: Sensitivity Testing

Parameter	Range	Data Source
Hydraulic Conductivity (m/day)	10 - 100	Values from literature were used to derive a range of hydraulic conductivity values for the site in the absence of slug tests within the Made Ground. BGS (2006) stated a range of 50 to 50,000 m/day for gravel and 5 to 500 m/day for sand and gravel. ConSim (2002) published a range of 25.92 to 2,592 m/day for a gravel. Morris & Johnson (1967) stated a range of 450 - 150 m/day for a fine to coarse gravel, whilst Tindall & Kunkel (1998) stated that largest range of 100,000 to 100m/day for a fine to coarse gravel. Based on these values and the absence of site specific data for the Slag Made Ground (sandy GRAVEL & COBBLES), a range of 10 to 100 m/day was selected for sensitivity testing. The above is consistent with the SBA DQRA with the selected value concurring with that of the SBA DQRA.

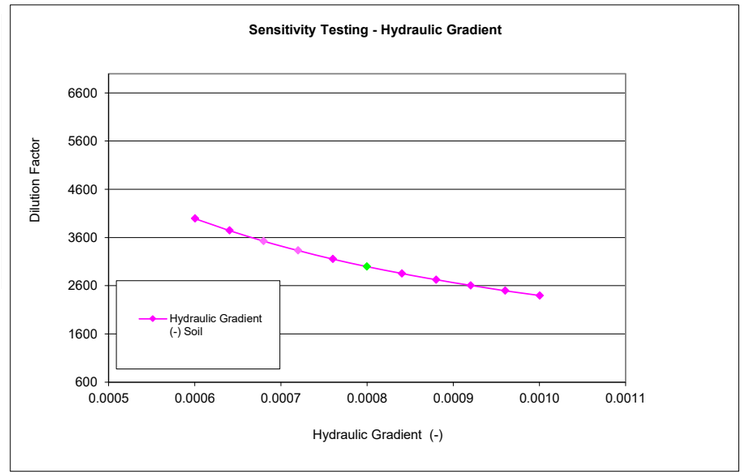
Hydraulic Conductivity (m/day) Soil	Dilution Factor
10	5993
16	3746
20	2997
28	2141
34	1763
40	1499
46	1304
52	1153
58	1034
64	937
70	857
76	789
82	732
88	682
94	638
100	600



Selected value highlighted in green	20

Parameter	Range	Data Source
Hydraulic Gradient (-)	0.0006 - 0.001	Hydraulic gradient was calculated using site specific groundwater elevation data gathered during groundwater monitoring events undertaken between October 2020 and June 2021 across Redcar South Bank. The wells selected for the calculation were those screening the Made Ground deposits in order to be representative of the modelled geological unit. The gradient was found to range from 0.0006 to 0.001, although a steeper gradient of 0.002 was idenifiied during one of the monitoring events. Hydraulic gradient and hydraulic conductivity are intrinsically linked, with the upper end of the value of 0.002 relatively steep for the range in hydraulic conductivity under consideration. Steep gradients are unable to support rapid hydraulic conductivity, and vice versa. As such a range of 0.0006 to 0.001 was considered for the purposes of sensitivity testing, which is in line with the range selected in the SBA DQRA.

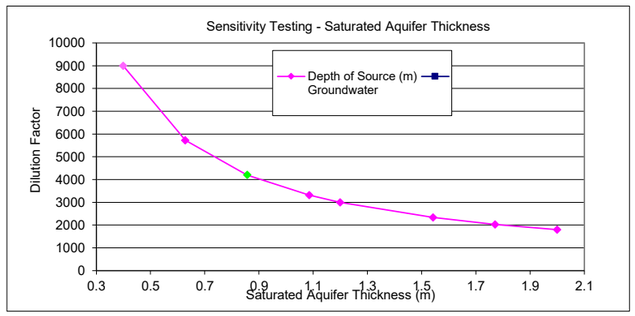
Hydraulic Gradient (-) Soil	Dilution Factor
0.00060	3996
0.00064	3746
0.00068	3526
0.00072	3330
0.00076	3155
0.00080	2997
0.00084	2854
0.00088	2725
0.00092	2606
0.00096	2498
0.00100	2398



Selected value highlighted green	0.0008

Parameter	Range	Data Source
Depth of Source (m)	0.4 - 2.0	Groundwater was typically encountered resting in the bottom half of the Slag Made Ground beneath Redcar South Bank during groundwater monitoring undertaken between October 2020 and June 2021. Most commonly, it was found to be saturating approximately the bottom 0.9 to 1.5m of this unit (considering average depth to water), however, the saturated thickness of the unit ranged from approximately 0.4 to 2.0m (with the exception of SBC_AUK_BH103 and SBC_AUK_BH109, where groundwater was resting either within the base of the Slag Made Ground or underlying natural deposits). As such, a range of 0.4m to 2.0m was considered for the purpose of sensitivity testing, which is generally in line with that defined for the SBA DQRA. It is noted that the selected value is consistent with that defined for the SBA DQRA.

Depth of Source (m) Groundwater	Dilution Factor
0.40	8989
0.63	5721
0.86	4196
1.09	3312
1.20	2997
1.54	2331
1.77	2031
2.00	1799



Selected value highlighted green	1.2

Appendix C

Physical Input Parameters

South Bank, Redcar	
Appendix C: Physical Input Parameters	
Parameter	Parameter Value
Aquifer Lithology	Made Ground comprising sandy gravel and cobbles
Width of groundwater source (m)	5,000
Depth of groundwater source (m)	1.20
Hydraulic conductivity (m/day)	20
Hydraulic gradient (m/m)	0.0008
Calculated groundwater flow rate (m^3/day)	96
River Gauging Station	River Tees (Leven Bridge & Low Moor)
Minimum monthly flow (m^3/day)	287,626
Calculated dilution factor	2,997

Appendix D

Risk Assessment Methodology

Appendix D
Risk Assessment Methodology

Non-statutory Regulatory Technical Guidance

The following documents, which have been consulted in undertaking this DQRA, present guiding principles in assessing potentially contaminated land:

General	Land Contamination: Risk Management (LCRM) (EA, 2020) available at: https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks (formerly CLR11: Model Procedures for the Management of Land Contamination (EA, 2004);
Water Resources	Remedial Targets Methodology (RTM): Hydrogeological Risk Assessment for Land Contamination (EA, 2006).

Calculating Evaluation Criteria

Water Resources

In order to estimate the risk to water resource receptors, fate and transport algorithms are used to predict a concentration at a defined receptor point, which is then compared to an appropriate water quality standard. A predicted concentration in excess of the water quality standard suggests the need to undertake a further level of investigation or action. Water resources SSAC are defined using a water quality standard at the point of compliance, then back-calculating to determine the contaminant level which is acceptable beneath the site in soils and/or groundwater.

The SSAC can be compared to the measured concentrations of the CoC to evaluate whether unacceptable risks are present, and with which pollutant linkage or linkages the unacceptable risks are associated.

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