AtkinsRéalis

Conceptual Site Model, Risk Assessment and Environmental Setting and Site Design Report

South Tees Development Corporation

January 2025

MAM1-ATK-ENV-FDRXX-RP-EN-000002

FOUNDRY CENTRAL WEST

Notice

This document and its contents have been prepared and are intended solely as information for South Tees Development Corporation and use in relation to the conceptual site model, risk assessment and environmental setting and site design report to support the environmental permit application for Foundry Central West.

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Document history

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Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
1.0	To support the permit application for Foundry Central West	NC	LW	GB	SB	May 2024
2.0	Boundary update	LW	LW	SB	SB	Jan 2025

Client signoff

Client	South Tees Development Corporation
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1. Introduction

AtkinsRéalis has been commissioned by South Tees Development Corporation (STDC) to apply for a bespoke environmental permit for deposit for recovery. The permit is for activities associated with material recovery which includes the treatment, storage, sampling and backfill associated with the construction of a development platform at Foundry Central West, located within the Teesworks site.

As part of the permit application, assessment of environmental risk from the operation of the permit is required, which are detailed within this document.

This document and assessments within have been written in accordance with the following Environment Agency (EA) Guidance:

- risk assessments for your environmental permit - GOV.UK (www.gov.uk);
- landfill operators: environmental permits - Plan the environmental setting of your site - Guidance - GOV.UK (www.gov.uk); and
- control and monitor emissions for your environmental permit - GOV.UK (www.gov.uk)

The structure of this report is as follows:

- Conceptual Site Model (CSM) for the site that includes sources of pollution that could impact human health or the environment, the pathways the pollution may follow to travel from the site and all the receptors that could be affected by it;
- development of an Environmental Risk Assessment (EAR) for the permitted activities being undertaken at the site; and
- Environmental Site Setting and Design (ESSD) report including amenity monitoring plan(s) for the site (if required).

A summary of the site and the works is included in the Waste Recovery Plan [1] which will be submitted with the permit application.

1.1 Document Structure

This document forms part of the additional information suite that is provided as part of the application for the Foundry Central West bespoke environmental permit for deposit for recovery. The structure of these additional information documents and how these documents relate to each other is shown in Table 1-1, and is designed so that information is not duplicated across documentation where possible. Core information regarding the site, its setting and details of the proposed document are provided within the Non-technical Summary and Additional Information [2] document (referred to herein as the Non-technical Summary) and therefore the information are not duplicated here. As such the reader should read the Non-technical Summary prior to reading this document.

Table 1-1 - Document Suite Structure to Support Permit Application

Suggested Reading Order	Document Title	Document Reference	
1	Waste Recovery Plan [1]	RCOX-ATK-ENV-FDRXX-RP-EN-000001.P1.03	Permit Forms (Parts A, B2, B4, F1)
2	Non-technical Summary and Additional Information [2]	MAM1-ATK-ENV-FDRXX-RP-EN-000001	
3	Conceptual Site Model, Risk Assessment and Environmental Setting and Site Design Report [3]	MAM1-ATK-ENV-FDRXX-RP-EN-000002	
4	Hydrogeological Risk Assessment [4]	10047374-AUK-XX-XX-RP-ZZ-815-01-FCW_HRA	
5	Ecological Risk Assessment [5]	INCA2024-14	
6	Waste Acceptance Procedures [6]	MAM1-ATK-ENV-FDRXX-RP-EN-000003	
7	Environmental Management System Summary [7]	MAM1-ATK-ENV-FDRXX-RP-EN-000004	

Document Signpost

Required reading	This document	Permit additional information documents

2. Conceptual Site Model (CSM) Development

2.1 Site Details

A site description including details of the site setting and surrounding area are including in section 2.1 of the Non-technical Summary [2], with further details on the site setting outlined in the Phase 1 Desk Study produced by Arcadis [8]. The following plans and information should be reviewed:

Site location plan	TSWK-STDC-FDR-ZZ-DR-C-0018
Site layout plan including surfacing and drainage	TSWK-STDC-FDR-ZZ-DR-C-0017
Conceptual site model	Presented in this section which has been produced in accordance with the EA Guidance: Landfill operators: environmental permits

2.2 Sources

2.2.1 Proposed Activity

Details of the proposed site activity are outlined in the Non-technical Summary [2]. Relevant information to provide context to the CSM has also been summarised briefly below.

Permitted activities undertaken at the site will comprise the treatment, storage and subsequent backfilling (deposit for recovery) the earthwork's envelope with material and construct the development platform. The details of this process are provided in the Waste Acceptance Procedure [6]. The Hydrogeological Risk Assessment [4] establishes the baseline conditions for the site and informs a monitoring regime sufficient to act as a trigger for further assessment and mitigation to manage the potential risk of the works to controlled waters receptors. The total quantity of material anticipated to be backfilled at the site is 602,195 m^3 and is limited by the final level of 7.1 m AOD. Material will be backfilled at the site in accordance with Series 600 of the Specification for Highways Works [9] and will align with the Arcadis Earthworks Specification [10].

Only material types which align to the EIC waste codes (as detailed in the Waste Recovery Plan [1] and Waste Acceptance Procedures [6]) will be accepted at the site for material recovery. The material backfilled at the site will have to meet the waste acceptance criteria which is presented in the Waste Acceptance Procedure [6]

The material backfill used at the site will be derived from the Made Ground excavated at the site and also supplemented by waste from the wider Teesworks site. To enable material recovery, the majority of material will requires treatment through one or a combination of the following methods as required:

- crushing;
- screening;
- blending (where material and environmental permit type allows); and
- stabilisation.

The backfill of the earthworks envelope will then be used to achieve the required development platform design. Any material that is not suitable for backfill at the site will be transferred off-site in accordance with the waste Duty of Care.

It is not anticipated that excavations will extend into groundwater, however where groundwater is encountered, the excavation shall be backfilled as soon as practicable (as stated in the Arcadis Remediation Strategy [11]). Should perched water with signs of visual and/or olfactory contamination be encountered e.g. in tank structures, this will be sampled and classified to allow appropriate disposal, either via direct disposal to public foul drainage under discharge consent, via on site treatment (on the wider Teesworks site) and discharge to public foul drainage under consent, or by tanker and disposal from site (as stated in the Arcadis Remediation Strategy [11]).

Detailed procedures for waste acceptance [6] (including the rejection of non-conforming waste) will be in place to ensure only permitted waste and material types are accepted at the site. Procedures for the receipt, handling, storage, treatment and backfilling of material will be included in the Environmental Management System for the site, which will be reviewed on an annual basis and briefed to all employees working on the site.

A drawing showing the proposed site layout is presented on TSWK-STDC-FDR-ZZ-DR-C-0022. Due to the nature of the works and the deployment of mobile treatment equipment, there will be no permanent treatment area on site. Recovered materials will be backfilled across the whole of the site and the sequence of backfill will be determined by the Contractor. Upon completion of the works and permit surrender, the site will be a development platform tied into the surrounding road network at 7.1 m AOD.

2.2.2 Historical Activity (including landfill sites and waste activity)

A full summary of the site history is presented in the Arcadis Phase 1 Desk Study [8]. A summary of surrounding features and historical processes is presented on drawing 10047374-AUK-XX-XX-DR-ZZ-729-01. Pertinent information is summarised in Table 2-1 below.

Table 2-1 - Summary of Historical Land Use

Historical Land Use	Distance From Site	Direction
On Site		
1927 – Historical maps indicate the site comprises mudflats. The tipping of materials from the Redcar Jetty are encroaching on the northern edge of the site, raising the north of the site above mean high water. There are no records of the composition of the tipped materials however it is assumed that the tipped materials are slag by-products from the ironworks located 1km to the east at Tod Point as well as sand fill from the River Tees. By 1968 historical maps show half the site has been reclaimed from the Tees estuary. By 1980 – 1983 the entire site has been raised above mean high water.	On site	On site
“Teesside Works Redcar” was constructed in the 1970’s, comprising numerous buildings and conveyors (operational 1980 to 2015). The works recorded a Notification of Installations Handling Hazardous Substances (NIHHS) and was later designated as a Control of Major Accident Hazards (COMAH) upper tier site. Works were decommissioned in October 2015. Since 2015, the site has been under regeneration with associated infrastructure demolished. The COMAH designation has recently been revoked.	On site	On site
Off Site (within the wider Teesworks boundary)		

Historical Land Use	Distance From Site	Direction
1893 – Historical maps show the South Gare Breakwater, Redcar Jetty and a tramway have all been constructed to the north of the site. The construction of the breakwater has resulted in the high tide level close to the northern boundary. It is assumed that all these structures are constructed of a mixture of slag by products from the ironworks located 1km to the east at Tod Point and sand from the River Tees.	Adjacent to the site	North, east and south
1923 – 1927 Historical maps show the area surrounding the site is beginning to be built up. The Redcar Iron and Steel works is shown approximately 400m to the east, beyond this the Warrenby Slag Works is also present. Areas of railway tracks associated with the iron works have been extended and built up.	Adjacent to the site	North, east and south
1969 – Historical maps show further areas to the north have been reclaimed from the estuary (reclaimed material is assumed to be site won slag and sand from the River Tees based on anecdotal evidence). In the east, the Redcar Iron and Steel Works is more developed with more tanks and buildings shown. A drainage system has been created within the marshes to the southeast.	Adjacent to the site	North, east, southeast
1974 – Historical maps show large areas to the south of the site have been reclaimed from the estuary (reclaimed material is assumed to be site won slag based on anecdotal evidence). Mapping shows railway infrastructure including multiple lines have been built to the south of the site.	Adjacent to the site	South
1980 -1983: The site is surrounded by the Teesside Works (formerly Redcar iron and Steel Works) including conveyors, blast furnace, coke ovens etc. The area has gone under major land development with buildings built upon the reclaimed land platform. The Redcar Jetty is no longer present towards the north and is assumed to have been buried by the reclamation activities (reclaimed material is assumed to be site won slag based on anecdotal evidence).	Adjacent to the site	North, east, south, west
1993 – Historical landfill record at Blast Furnace Plant for Industrial waste (reference: YP4/L/BRI002). The licence was issued in July 1993 and the operator was British Steel Corporation.	333 m	North east
2015 - The Teesside Redcar works have been decommissioned and have since undergone demolition to facilitate the reuse and regeneration of the site as part of the Teesworks project.	Adjacent to the site	North, east, south, west
Off-site (external to the Teesworks boundary)		
1929 – Historical maps indicate ground working and a refuse heap on South Gare. This is recorded as a historical waste site in the Groundsure report. Details of what was placed in the refuse heap is unknown.	429 m	North east
1977 – There is an active environmental permit for Bran Sands Landfill; permitted as “A02: Other Landfill Site taking Special Waste” (permit number: FB3601GS) operated by York Potash Processing & Ports	359 m	South west

Historical Land Use	Distance From Site	Direction
Limited. The permit was issued in May 1977. The Arcadis desk study refers to this as the ICI tip / facility.		
1979 - Historical landfill record at "Land Adjacent to Redcar Blast Furnace", licensed to accept industrial waste and inert waste (reference: YP1/L/BRI012). The licence was issued in December 1979 and surrendered in April 1997.	474 m	North east
2018 - Redcar bulk terminal (RBT) is a permitted site under Environmental Permitting Regulations 2016 (permit number (QP3338HU)). RBT is outside of the STDC site boundary. The permit for RBT covers the activities of metal recycling (waste operation), the screening, grading or mixing of coal, coke or any other coal product and the loading or unloading of petroleum coke, coal, coke or any other coal product (installation). The permit was issued in July 2016. The registered office is 79 m south west of the site, with the works adjacent along the western boundary of the site, extending north and south.	Adjacent to the site	West

2.2.2.1 Ground Investigation Works

A summary of the site investigations undertaken across the site and in the surrounding areas is presented in the Arcadis Phase 1 Desk Study [8] and also included in Table 2-2 below. Historical exploratory hole locations are presented on drawing 10047374-AUK-XX-XX-DR-ZZ-770-01 within the Arcadis Desk Study [8].

The site primarily consists of **slag rich Made Ground** (a by-product of the Teesworks sites' former use for the production of iron and steel), and **Sand Fill** comprising of material dredged from the River Tees. This material closely resembles the natural **Tidal Flat** deposits which are likely to be present beneath both these materials. A summary of the anticipated ground conditions is further discussed in the Waste Recovery Plan [1].

Table 2-2 - Summary of previous ground investigations

Ground Investigation Report	Ground Investigation Summary	Outcome of Ground Investigation
2008 Corus [12]. Works undertaken to the north of the site in the area around the Redcar Coke Ovens and By-products plant, to investigate potential contamination from Ammoniacal Liquor Storage Tanks.	3 x boreholes (10 m bgl, to 12 m bgl) 8 x trial pits (4 m bgl) Ground water and soil vapour monitoring Soil and groundwater samples obtained	Intrusive holes encountered slag rich Made Ground between 5.5 to 6.0 m thick at the surface. This overlies natural soils; alluvium comprising brown silty sand. No evidence of visual or olfactory contamination was observed. Soil and groundwater samples did not find elevated levels of pollutants.
April 2018 AEG on behalf of CH2M [13]. Works undertaken to the south of the site in order to	7 x boreholes (15.5 m bgl to 40.3 m bgl) Gas and groundwater monitoring.	Ground conditions encountered Made Ground at the surface comprising gravelly clay / clayey gravel including clinker, slag and coal, to between 0.8 m

Ground Investigation Report	Ground Investigation Summary	Outcome of Ground Investigation
determine ground conditions across	Soil and groundwater samples obtained for	and 7.8 m bgl. Groundwater was generally encountered within the Made Ground. Made Ground overlies natural deposits comprising sand to between 7.8 m and 11.8 m bgl. Localised chemical and hydrocarbon odours were noted in the sand. Sand overlies soft to stiff clay with some gravel of mudstone and sandstone to between 15.4 m to 22.2 m bgl. This overlies Mudstone which was recorded to the base of all exploratory boreholes.
June 2018 AEG on behalf of Arcadis [14]. Works undertaken across the footprint of the former Redcar Steel Works, including the site and surrounding area. The purpose of the investigation was to assess the ground and groundwater conditions and obtain samples for geotechnical and chemical analysis.	31 x boreholes (0.5 m bgl to 27.4 m bgl) including 7 deep boreholes (39.8 m bgl and 41.0 m bgl) 15 x trial pits (4.5 m bgl) Gas and groundwater monitoring (including tidal monitoring). Samples obtained for laboratory geotechnical and chemical testing.	Made Ground was encountered at the surface comprising sometimes clayey sandy gravel with cobbles comprising slag, brick concrete and clinker between 3.0 m and 8.9 m thick. Olfactory evidence of contamination was noted, recorded as a hydrocarbon, creosote, tar, ammonia and sulphurous odours in the Made Ground. Groundwater was generally encountered within the Made Ground. Monitoring did not indicate a tidal influence. Made Ground was recorded as overlying natural deposits comprising sand with shells to between 8.5 m bgl and 18.0 m bgl.

2.2.3 Pollution Incidents

2.2.3.1 On Site

From a review of the Groundsure report obtained as part of the Arcadis Desk Study, no pollution incidents have been recorded on the site.

2.2.3.2 Off Site

A pollution incident was recorded 16m south east in 2009 for dust in relation to a “Significant” impact to air. The impact to land and water was recorded as “minor” and “no impact” respectively. The source of the incident is unknown.

2.3 Receptors

2.3.1 Amenity

Foundry Central West is part of the wider Teesworks site, presented on drawing TSWK-STDC-FDR-ZZ-DR-C-0018. Redevelopment works are ongoing on the wider Teesworks, surrounding the site to the north, east and south of the Foundry Central West site. Foundry Central West is located within Teesworks, with the Teesworks boundary being located approx. 390 m north east, 40 m north west, 70 m south west and 1.26 km east.

The surrounding land use and nearby amenities are summarised in Table 2-3 below and shown on drawing TSWK-STDC-FDR-ZZ-DR-C-0023.

To the west of the Foundry Central West is Redcar Bulk terminal, used for material storage and processing. The adjacent land uses within the wider Teesworks boundary are not considered to be sensitive.

Table 2-3 - Summary of Amenity Receptors

Identified Amenity Receptors	Distance from Site	Direction	Comment
Adjacent remediation and construction works (wider Teesworks site)	Adjacent	North, east and south	Ongoing / proposed works at adjacent sites are similar to those that will be undertaken at the site.
Redcar Bulk Terminal	70 m	South west	Industrial site has limited personnel, with works undertaken using vehicles / plant.

The following receptors summarised in Table 2-3 have been discounted based on distance from the site and therefore the potential impact of the works.

Table 2-4 - Summary of Discounted Amenity Receptors

Discounted Receptors Based on Distance (included in this table for context)			
Coatham Sands (used as recreational space)	390 m	North east	Land adjacent to wider Teesworks boundary
Cleveland golf club	1.4 km	East	-
Residential properties at Warrenby	2 km	East	Nearest residential properties to the site
Dormanstown Primary Academy	2.8 km	South east	Nearest school to the site
Redcar Primary Care Hospital	4.7 km	South east	Nearest hospital and care home to site
Durham Tees Valley civil aerodrome	23 km	North east	Nearest safeguarded aerodrome. Proposed works are below the minimum height of necessary consultation

2.3.2 Habitats and Natural Heritage

The pathways and receptors for habitat and natural heritage have been assessed within the INCA Ecological Risk Assessment [5]. Specific features of the coastline and the distance from the site are summarised in Table 2-5 below. There are two internationally designated sites within 1 km of the site boundary; the Teesmouth and Cleveland Coast Special Protection Area (SPA) and the Teesmouth and Cleveland Coast Ramsar site. The SPA and Ramsar site share the same boundary, except where the SPA has a marine component (the intertidal element of the SPA is also a European Marine Site), and share the same interest features. Further detail can be found within the ERA and should be reviewed in conjunction with this document.

Table 2-5 – Ecological Risk Assessment Summary as Identified in the ERA

Section	Summary			
Receptors – Internationally and Nationally Designated Sites	**Identified Habitat Receptors**	**Distance from Site**	**Direction**	**Comment**
	Coatham Quarry and lagoons	344 m	North	SSSI, conserved wetland site, SPA and Ramsar site.
	Bran Sands Lagoon and Dabholme Gut	392 m	South west	SSSI, conserved wetland site, SPA and Ramsar site.
	Brans Sands	510 m	North west	SSSI, conserved wetland site, SPA and Ramsar site.
	South Gare and Coatham Dunes	580 m	North	SSSI, conserved wetland site, SPA and Ramsar site.
	Interesting features include: • EU Directive Wild Birds SPA • Wetlands (Ramsar) • Non-breeding birds (SSSI), • breeding birds (SSSI), • sand dunes (SSSI); and • invertebrate associated with sand dunes (SSSI).			
Receptors – Locally Designated Sites	There are no designated National Landscapes (formerly known as Areas of Outstanding Natural Beauty [AONBs]), national parks or nature reserves within 2 km of the site.			
Receptors – Protected Species	Species that have been confirmed to be present of have the potential to be present within the South Tees area are: • Otters; • Nesting birds; • Invasive Species			
Potential Pathways Identified During Excavation and Material Recovery	**Internationally Designated Sites** **Loss of habitat outside of the SPA which supports SPA birds** There are extensive areas of bare substrate with compacted ground, therefore no suitable habitat for SPA birds and therefore this pathway has been screened out. **Visual disturbance to SPA birds** Closest area used by SPA birds are Bran Sands Lagoon 300m to the south. No visual disturbance is anticipated at this distance. **Noise disturbance to SPA birds** SPA birds do not occur closer than 300m from the site. At that distance noise attenuation would be such that there would be no significant increase above the baseline levels to which the birds are habituated. **Discharge of water borne pollutants to the SPA** Without mitigation there is the potential for soil leachate to migrate to groundwater and via groundwater to the SPA. The risk of contaminants leaching from soils and migration of			

Section	Summary
	groundwater is assessed in the Arcadis Remediation Strategy [11] and the Hydrogeological Risk Assessment [4]. Subject to the required mitigation measures associated with the Hydrogeological Risk Assessment being implemented it is considered that there would be no adverse impact on the SPA from water borne pollutants. **Discharge of dust and particulates to the SPA.** There is the potential for dust and other particulates to disperse from the site to the SPA. Measures to limit the amount of dust generated will be controlled by standard dust suppression measures as part of a Construction Environment Monitoring Plan (CEMP) which will be implemented as part of the planning process. **Nationally Designated Sites** **Breeding and non-breeding birds** The impact is the same for breeding and non-breeding birds as it is for the features of the SPA. Therefore, the potential impacts on the SSSI birds have been ruled out for the same reasons as the SPA. **Sand dunes and associated invertebrates** Potential effect would be via deposition of dust and particulates. The control measures for dust and particulates which will be implemented as part of the CEMP are considered sufficient to prevent the impacts on the SSSI. **Protected Species** **Otter** As otters could potentially traverse the site then there is the possibility of them falling into and being trapped in excavations. This would apply to other large and mobile mammal species which are found in the surrounding area, such as hares, deer and hedgehogs. While these other species are not protected by law, nevertheless mitigation to prevent harm to them would be good practice. **Nesting Birds** There is the potential for bird's nests to be damaged or destroyed during works. In addition, Schedule 1 bird species are protected from disturbance whilst they are nesting. **Invasive Species** Although no invasive species have been recorded on the Site, there is the potential for them to be present given that they could disperse from the surrounding area.
Outcome	The INCA assessment has identified the following control measures, to ensure compliance with legal requirements relating to ecology: • measures to prevent waterborne contaminants affecting designated sites in accordance with the Hydrogeological Risk Assessment [4]; • implementation of the CEMP to prevent dust and particulates affecting designated sites; • measures to prevent otters of other mammals being trapped in excavations inc. covering small deep excavations outside of working hours and including a ramp into the excavation; • prior to works commencing, a survey for invasive plant species should be undertaken by a suitably experienced ecologist. Should invasive species be found then a management plan, appropriate to the species identified, will be put in place prior to work commencing to prevent the spread of these species; and • a nesting bird check by an ecologist should take place within 48 hours of works commencing, or of works commencing on any new areas of the site. Should

Section	Summary
	nesting birds be found to be present then a suitable buffer zone will be established around the nest(s) so that no harm or, if relevant disturbance, takes place. This will need to be repeated should new areas of the Site be worked after the initial check.

2.3.3 Controlled Waters

The pathways and receptors for controlled waters have been assessed within the Arcadis Hydrogeological Risk Assessment [4]. Table 2-6 provides a summary of the receptors assessed. Further detail can be found within the Hydrogeological Risk Assessment [4] and should be reviewed in conjunction with this document (as per Table 1-1).

Table 2-6 – Controlled Waters Receptors

Receptor	Comment
Surface water	The closest surface water receptor is the lagoon associated with Bran Sands and the Tees Estuary located approximately 400 m south-west of the site. The Bran Sands Lagoon and Tees Estuary are considered to be in hydraulic continuity. There are also several artificial ponds / water storage areas within the vicinity of the site. The closest is located approximately 250 m east. The ponds are associated with industrial infrastructure, are not considered to be in hydraulic continuity with the groundwater and have been discounted as a receptor.
Geology	The regional geology is summarised in the Arcadis Phase 1 Desk Study [8] based on Sheet 34, Guisborough 1:50,000 scale published geological map and 1:10;000 digital mapping as extensive Made Ground within the footprint of the site underlain by Tidal Flat Deposits, and below this Glaciolacustrine Deposits in some areas. Bedrock geology is recorded to be the Redcar Mudstone across the south eastern edge of the site and the Mercia Mudstone across the rest of the site. The Penarth Group (mudstone with sandstones) is indicated to be present in a narrow band between these units.
Aquifer characteristics	The site is not located within a groundwater Source Protection Zone (SPZ). There are no groundwater abstraction licences on or within 500 m of the site. Groundwater within the underlying superficial deposits (Tidal Flat Deposits) and the bedrock (Redcar Mudstone Formation and Penarth Group and Mercia Mudstone Formation) are considered receptors. Summary of aquifer designation: • Tidal Flat Deposits: Secondary A Aquifer; • Redcar Mudstone Formation: Secondary Undifferentiated Aquifer; • Penarth Group: Secondary B Aquifer; and • Mercia Mudstone Formation: Secondary B Aquifer.
Groundwater flow	Groundwater flow is inferred towards the west or south west within the Tidal Flat Deposits, and to the south west within the bedrock geology. The groundwater is considered to be in continuity between the Made Ground, superficial deposits and bedrock, with some degree of reduced permeability associated with cohesive superficial deposits. A tidal influence is not considered to be present in superficial deposits below the site. Within the bedrock, data from one monitoring well showed a tidal response.

Receptor	Comment
Groundwater quality	Baseline groundwater monitoring from October 2023 has identified the presence of the following widespread contaminants of concern present above laboratory method detection limits: • metals (arsenic, chromium VI, lead, mercury) • cyanide • ammoniacal nitrogen • benzene • naphthalene, benzo(a)pyrene
SPA and Ramsar site (Bran Sands Lagoon, Dabholme Gut and Bran Sands)	This receptor is identified in the Ecological Risk Assessment [5], however the associated pathways are considered to be assessed simultaneously with other groundwater receptors.

3. Conceptual Site Model Summary

A summary of the Conceptual Site Model (CSM) is presented in Table 3-1. Drawing TSWK-STDC-FDR-ZZ-DR-C-0023 identifies the receptor locations. These pathways have been carried forward into the Environmental Risk Assessment in Section 4.

Table 3-1 - CSM Summary

Source	Pathway	Receptor	Distance to receptor
Excavation of waste Material recovery and backfilling Transportation of waste (within Teesworks curtilage on internal road network, and occasionally on public highway)	Odour related to NAPL	On site construction workers	On site
		Off site workers at adjacent construction / industrial sites	0 m
	Noise	On site construction workers	On site
		Off site workers at adjacent construction / industrial sites	0 m
	Vibration	On site construction workers	On site
		Off site workers at adjacent construction / industrial sites	0 m
	Dust (including asbestos fibres from asbestos containing material)	On site construction workers	On site
		Off site workers at adjacent construction / industrial sites	0 m
		On site – dust on cars, equipment etc.	On site
		Adjacent roadways	0 m

Source	Pathway	Receptor	Distance to receptor
		SPA and Ramsar site (Bran Sands Lagoon, Dabholme Gut and Bran Sands) and protected species	392 m

The risk from contaminants via leaching and groundwater migration to controlled waters and ecological receptors is assessed within the Hydrogeological Risk Assessment [4] and so has not been considered further in the CSM or within the Environmental Risk Assessment in Section 4.

The risk to surface water is also considered as part of the Hydrogeological Risk Assessment [4]. There are no surface drainage ditches or ducts at the site which would create discharge directly into surface water receptors, and migration to surface water via groundwater has been assessed via the Hydrogeological Risk Assessment [4].

A summary of discounted sources and pathways to amenity and habitat receptors is presented in Table 3-2 and Table 3-3 below. These pathways have not been included in the Environment Risk Assessment in Section 4.

Table 3-2 – Summary of Discounted Amenity Sources

Discounted Item	Justification
Litter	The types of waste/material accepted will not produce wind-blown debris and litter.
Odour	The types of waste/material accepted will typically not produce odour. The exception to this is where NAPL is encountered.
Pests and scavenging animals and birds	The types of waste/material accepted will not attract pests or scavenging animals and birds.
Ground gas	The material used for backfilling will not generate ground gas. Any risk of ground gas from material recovery will be considered by the tenant as part of the future development.
Stability of the recovered material	The material used for backfilling will be suitable to create a stable development platform in accordance with the waste acceptance procedures (which includes reference to the earthworks specification).

Table 3-3 – Summary of Discounted Amenity and Habitat Pathways

Amenity Pathways	
Vibration	No sensitive receptors from vibration are present within 100 m of the site boundary. The 100 m screening criteria has been taken from Design Manual for Roads and Bridges LA 111 Noise and Vibration Revision 2 May 2020 which states “a study area of 100 m from the closest construction activity is normally sufficient to encompass vibration sensitive receptors”.
Dust	No sensitive receptors from dust are present within 250 m of the site boundary. The 250 m screening criteria has been taken from IAQM Guidance on the assessment of dust from demolition and construction, January 2024 (Version 2.2).
Noise	No sensitive receptors from noise are present within 300 m of the site boundary. The 300 m screening criteria has been taken from Design Manual for Roads and Bridges LA 111 Noise and Vibration Revision 2 May 2020 which states “a study area of 300 m from the closest construction activity is normally sufficient to encompass noise sensitive receptors”.
Habitats and Ecological Pathways (summarised from the Ecological Risk Assessment [5]**)**	

Loss of habitat	Site is predominantly bare ground which was formerly buildings or roads and therefore compacted. No suitable habitat for SPA birds has been identified under existing conditions and no detrimental change.
Visual disturbance	The SPA at its closest point is over 300 m from the site boundary (Bran Sands Lagoon), no visual disturbance is anticipated at this distance. Additionally, there are existing operational activities on in the intervening distance which potentially cause more visual disturbance but are not considered to be having an adverse effect on the SPA.
Noise / vibration	The SPA at its closest point is over 300 m from the site boundary (Bran Sands Lagoon), no significant increase in noise and vibration above the baseline levels to which birds are habituated.

This Conceptual Site Model is based on the information described in Sections 1 and 2. Full assessment of the risk associated with the permitted activity (materials recovery) is presented in Section 4.

4. Environment Risk Assessment (Part B2, 6)

A risk assessment has been produced based on the identified sources, pathways and receptors as outlined in Table 3-1 above. A qualitative risk matrix and definition of risk is presented in Appendix A.

Table 4-1 - Environmental Risk Assessment

Hazard	Process	Pathway	Receptor	Probability of Exposure	Consequence	Initial risk	Managing the Risk	Residual Risk
Odour								
Odour (nuisance)	Odours generated from waste/materials on site. Permitted waste types are not considered to be odour generating however excavation and subsequent storage of limited tar / NAPL hotspots may generate odour before transfer of waste off-site for treatment and / or disposal.	Air transport	On site construction workers Off site workers at adjacent construction / industrial sites	Low – exposure will be short duration, limited volume of waste (if encountered)	Minor – short duration	Very Low Risk	Limited volume of odour generating waste/materials, which will be temporarily stored on-site for transport and treatment/disposal off-site. The permitted waste/materials types are not odour generating and waste acceptance procedures will be in place. Loads of odour generating waste to be covered when travelling on the public highway. Details of odour management to be documented in the CEMP.	Very Low - based on mitigation measures in place.
Noise								
Noise (nuisance)	Vehicle engine noise (including heavy plant), general construction activities (breaking out obstructions etc.) and operation of temporary generators and plant including crushers and screeners.	Noise travelling through the air	On site construction workers Off site workers at adjacent construction / industrial sites	Low – site works limited to standard working hours, project duration less than one year, neighbouring sites are of similar nature (construction)	Moderate to Mild – nuisance to on and off-site workers	Low	Design works in accordance with BS5228:2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites'. Plant with inbuilt noise suppression to be deployed as preference and utilised (e.g. acoustic covers and pneumatic percussive tools fitted with mufflers or silencers of the type recommended by the manufacturers). Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum. Site personnel to wear hearing protection where required. Working hours to be in line with planning condition requirements (daytime, typical working hours). Noise management to be documented in the CEMP.	Very Low – based on mitigation measures in place, risk will be managed by measures detailed in the CEMP.

Hazard	Process	Pathway	Receptor	Probability of Exposure	Consequence	Initial risk	Managing the Risk	Residual Risk
Vibration								
Vibration (nuisance)	General construction activities (breaking out obstructions etc.) and operation of heavy plant and vehicles including backfilling.	Ground	On site construction workers Off site workers at adjacent construction / industrial sites	Low – site works limited to standard working hours, project duration less than one year, neighbouring sites are of similar nature (construction),	Mild – nuisance to off-site workers and SPA birds	Low	Design works in accordance with BS5228:2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites'. Minimise drop heights when loading materials or placing on the ground. Working hours to be in line with planning condition requirements (daytime, typical working hours). Vibration management to be documented in the CEMP.	Very Low - based on mitigation measures in place, risk will be managed by measures detailed in the CEMP.
Dust								
Respirable fugitive dust	Releases of dust due to site activities (excavation, crushing and processing, vehicle and plant movement).	Air transport and inhalation	On site construction workers Off site workers at adjacent construction / industrial sites	Low – Workers are largely plant operators and therefore within an enclosed space. Prevailing wind is from the south west, away from receptors [15].	Medium - risk of respiratory illness to identified human receptors	Moderate / low	Design works in accordance with industry guidance 'Control of dust from construction and demolition activities, BRE, February 2003'. Plant with inbuilt dust suppression to be deployed as preference and utilised. Dampening down of surfaces using a tractor towed bowser when visual dust is observed. Pre-emptive dampening of road network during dry and / or windy conditions. Background dust monitoring undertaken prior to the start of works at four points around the site perimeter to determine baseline dust levels from the adjacent industrial/construction sites. Visual dust monitoring undertaken daily by the site manager including recording wind strength and direction. Quantitative dust monitoring undertaken at intervals to support visual assessments. Dust management and monitoring to be documented in the CEMP, with reference to 'Guidance on the assessment of dust from demolition and construction, IAQM, January 2024'.	Low – based on mitigation measures in place, risk will be managed by measures detailed in the CEMP.
Nuisance fugitive dust deposited on cars, clothing etc. and in the SPA / protected species	Releases of dust due to site activities (excavation, crushing and processing of materials, vehicle and plant movement).	Air transport and deposition	On site – dust on cars, equipment etc. Adjacent roadways Note that clothing has been discounted due to PPE controls SPA (Bran Sands Lagoon, Dabholme Gut and Bran Sands)	Low – Prevailing wind is from the south west, away from receptors [15]	Medium - Short term increase in sediment load on vehicles, equipment, SPA etc.	Moderate / low		Low - based on mitigation measures in place, risk will be managed by measures detailed in the CEMP.
Asbestos containing materials	Releases of fibres due to site activities(excavation, crushing and processing of materials, vehicle and plant movement).	Air transport and inhalation	On site construction workers Off site workers at adjacent construction / industrial sites	Low – Workers are largely plant operators and therefore within an enclosed space. Prevailing wind is from the south west, away from receptors [15].	Medium - risk of respiratory illness to identified human receptors	Moderate	Design works in accordance with industry guidance 'Control of Asbestos Regulations 2012, Joint Industry Working Group'.	Low - risk will be managed by measures detailed in the CEMP in accordance with CAR, 2012.

Hazard	Process	Pathway	Receptor	Probability of Exposure	Consequence	Initial risk	Managing the Risk	Residual Risk
Spreading of gross contamination during excavation	Excavation of limited hotspots of gross contamination (e.g. NAPL)	Lateral and vertical migration to controlled water receptors	Underlying ground and groundwater	Likely	Mild – material is site derived and works are for site improvement purposes	Moderate / Low	Limited volume of gross contamination anticipated which will be temporarily stored on hardstanding to prevent run-off (and bunded if required) for transport and treatment / disposal off-site. Waste with gross contamination to be sheeted whilst awaiting collection for disposal off-site. The client's ground remediation consultant (Arcadis) have a watching brief over the works and will advise on temporary storage location and handling. Managed via the process detailed within the approved remediation strategy and CEMP.	Low - based on mitigation measures in place, risk will be managed by measures detailed within the remediation strategy and CEMP.
Spillage of liquids (including oil)	Accidental spillage of chemicals / oil used on site	Lateral and vertical migration to controlled water receptors	Controlled water receptors	Low	Medium	Moderate / Low	Chemicals and fuels to be stored and handled in accordance with COSHH assessments. Dedicated refuelling area for plant on an impermeable surface. Drip trays to be available as per contractor's risk assessment and deployed. Spill kits to be available as per contractor's risk assessment and deployed. Managed via the process detailed within the approved remediation strategy and CEMP.	Low – based on mitigation measures in place, risk will be managed by measures detailed within the remediation strategy and CEMP.
Surface water run-off	Surface water run-off during periods of heavy rainfall	Run-off	Underlying ground and groundwater	Likely	Mild – material is site derived and pre-accepted for treatment	Moderate / Low	Limited volume of run-off anticipated due to permeable nature of the site. Materials are site derived and pre-accepted prior to excavation. Excessive run-off managed in line with the remediation strategy (provision of temporary drainage facilities). Managed via the process detailed within the approved remediation strategy and CEMP.	Low – based on mitigation measures in place, risk will be managed by measures detailed within the remediation strategy and CEMP.
Mud on roads resulting in dangerous driving conditions / nuisance to other road users	Vehicle movements to and from site tracking mud onto roads or from loads which are not properly contained.	Vehicles bringing waste/material to and from site.	Off site – Users of the public highway	Unlikely – Minimal vehicle movement off-site, most of which will be using the internal road network to access the wider Teesworks site. Distance to public highway is 3 km.	Medium – Risk of accident and injury	Low	Waste movement off-site is limited to material that does not conform with the Waste Acceptance Procedures [6], the majority of excavated waste will be accepted, treated and processed within the site boundary. Transportation of waste to be covered on public highway. Designated haul roads within site, and internal tarmac road network within wider Teesworks site. Distance to the Teesworks gatehouse and public road network is approximately 3km, during which it is unlikely that site derived mud will remain on tyres. Managed via the process detailed within the CEMP.	Low – based on mitigation measures in place, risk will be managed by measures detailed in the CEMP.

Hazard	Process	Pathway	Receptor	Probability of Exposure	Consequence	Initial risk	Managing the Risk	Residual Risk
Mud on roads resulting in dangerous driving conditions / nuisance to other road users	Vehicle movements to and from site tracking mud onto roads or from loads which are not properly contained	Vehicles bringing materials and plant to and from site	On site – Construction workers Off site – Users of private Teesworks road network (workers at adjacent construction / industrial sites).	Low – Surrounding sites are of the same nature. Site workers are inducted onto Teesworks site. Within the Teesworks site boundary, haul roads are only accessed by trained personnel in appropriate vehicles.	Medium – Risk of accident and injury	Moderate / Low	Site speed limit enforced. Site induction includes the presence of construction traffic, and a site speed limit of 30 mph. Waste movement on and off-site is limited; the majority of excavated waste will be accepted, treated and processed within the site boundary. Designated haul roads within site, accessed by dedicated vehicles (4 wheel drive) and subject to induction on a site by site basis. Managed as outlined within the CEMP.	Low – based on mitigation measures in place, risk will be managed by measures detailed in the CEMP.
Injury / illness to unauthorised personnel	Unauthorised access by local people	Arson / and or vandalism causing release of polluting materials to air (smoke). Air transport of smoke to receptors. Spillage of polluting liquids to water or land.	On site construction workers Trespassers Controlled waters receptors	Unlikely – minimal polluting materials on-site	Mild – limited volumes of polluting materials on-site	Very low	Wider Teesworks site is secure (boundary, gatehouses, patrols) to prevent access by unauthorised personnel. Site left secure at the end of each day. Waste/material stored on-site are not flammable. Polluting liquids / chemicals stored in accordance with COSHH assessments to prevent unauthorised access and use. General waste skips covered and locked overnight. Managed via the process detailed within the approved remediation strategy and CEMP.	Very Low - based on mitigation measures in place, risk will be managed by measures detailed within the remediation strategy and CEMP.
Injury to protected species	Disturbance to nests	Permitted activity in proximity to nesting birds (should they be present on-site)	Nesting Birds	Low – small interval between completion of demolition works and commencement of remediation works, therefore the opportunity for nest establishment is small	Medium – risk of injury to protected species	Moderate / Low	Nesting bird check by an ecologist to take place within 48 hours of works commencing, or of works commencing on any new areas of the site. Should nesting birds be found to be present then a suitable buffer zone will be established around the nest(s) so that no harm or, if relevant disturbance, takes place. This will need to be repeated should new areas of the site be worked after the initial check. Requirement to be outlined in the CEMP.	Low - based on mitigation measures in place, risk will be managed by measures detailed in the CEMP.
Injury of protected species	Trapped in deep excavations	Trapped in deep excavations	Large mobile mammal species including otters, hares, deep, badgers, hedgehogs	Low – limited potential for steep sided excavations as majority of excavations will be wide and shallow with a ramp for plant and machinery access	Medium – risk of injury to protected species and over mobile mammals	Moderate / Low	Measures to prevent otters of other mammals being trapped in excavations inc. covering small deep excavations outside of working hours and including a ramp into the excavation. Requirement to be outlined in the CEMP.	Low - based on mitigation measures in place, risk will be managed by measures detailed in the CEMP.
Spread of Invasive Species	Excavation and re-use of materials spreads invasive species	Spread of invasive species during earthworks	Impact to material currently free from invasive species	Unlikely – invasive species have not been recorded on the site	Mild – volume of material impacted would be small due to recorded	Very low	Prior to works commencing, a survey for invasive plant species will be undertaken by a suitably experienced ecologist. Should invasive species be found then a management plan, appropriate to the species identified, will be put in place prior to work	Very Low - based on mitigation measures in place, risk will be managed by

Hazard	Process	Pathway	Receptor	Probability of Exposure	Consequence	Initial risk	Managing the Risk	Residual Risk
					absence of invasive species		commencing to prevent the spread of these species. Requirement to be outlined in the CEMP.	measures detailed in the CEMP.

The risk assessment demonstrates that with the implementation of control measures as managed through the CEMP, the risk to human health and the environment from the permitted activities is low to very low.

5. ESSD Report

The headings for this section of the document align with the information requirements as included in the EA guidance: Landfill operators: environmental permits - What to include in your environmental setting and site design report - Guidance - GOV.UK (www.gov.uk)

5.1 Report Context

Operator of the proposed activity	South Tees Development Corporation
Agent who completed this report	AtkinsRéalis
Outline of proposed activity and how it relates to previous land use	Please refer to Section 2.2.1 above

5.2 Site Details

Site details	Summarised within the AtkinsRéalis Non-technical summary for the site [2]
Site location and access	Please refer to Section 2 within the Non-technical summary (site description) [2]
Site classification	Deposit for Recovery
Site boundary and site security	Please refer to Section 2 within the non-technical summary (site description) [2]
Relevant, adjacent former waste management activity boundaries	Please refer to section 2.2.2 above
Site context	The location of the site and surrounding land use is summarised in Section 2 of the non-technical summary (site description) [2]. The identified nearby receptors are outlined in Section 2.3 above
How the operations will be adapted at the site to account for the impact of climate change	Please refer to Section 2 of the non-technical summary (Development Platform Construction) [2]

5.3 Compliance Points

There are no point source emissions associated with the permitted activity and therefore there are no associated compliance monitoring points.

6. Pollution Control Measures

Details of the pollution control measures that will be implemented, and at what stage of the project lifecycle, are summarised in Table 6-1 below.

Table 6-1 - Pollution Control Measures

Potential Hazard	Stage of Project Lifecycle	Control Type (management or technical)	Control Action	Control Location
Odour in respect to NAPL	Excavation and material recovery	Management	Odour Management to be outlined within the CEMP. Odour generating waste/material to be covered when travelling on the public highway.	Source control
		Technical	Waste Recovery Plan and Waste Acceptance Procedure [6] do not include odour generating materials.	Material acceptance and source control
Noise and vibration	Excavation and material recovery	Management	Design works in accordance with BS5228:2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites'. Noise and vibration management to be outlined within the CEMP.	Documented in the CEMP
		Technical	Plant with inbuilt noise suppression to be deployed as preference and utilised (e.g. acoustic covers and pneumatic percussive tools fitted with mufflers or silencers of the type recommended by the manufacturers). Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum. Site personnel to wear hearing protection where required.	Source control (plant and machinery)

Potential Hazard	Stage of Project Lifecycle	Control Type (management or technical)	Control Action	Control Location
			Working hours to be in line with planning condition requirements (daytime, typical working hours). Minimising of drop heights when loading materials or placing on the ground.	
Fugitive dust	Excavation and material recovery	Management	Design works in accordance with industry guidance 'Control of dust from construction and demolition activities, BRE, February 2003'. Design works in accordance with industry guidance 'Control of Asbestos Regulations 2012, Joint Industry Working Group'. Dust management and trigger monitoring to be outlined within the CEMP, with reference to 'Guidance on the assessment of dust from demolition and construction, IAQM, January 2024'.	Documented in the CEMP
		Technical	Assessment of risk of asbestos containing materials to the operation of the works to be undertaken in line with 'Control of Asbestos Regulations 2012, Joint Industry Working Group' and documented in the CEMP.	Source control
		Technical	Plant with inbuilt dust suppression to be deployed as preference and utilised. Dampening down of surfaces using a tractor towed bowser when visual dust is observed. Pre-emptive dampening of road network during dry and / or windy conditions.	Source control

Potential Hazard	Stage of Project Lifecycle	Control Type (management or technical)	Control Action	Control Location
		Technical	Background dust monitoring undertaken prior to the start of works at four points around the site perimeter to determine baseline dust levels from the adjacent industrial / construction sites. Visual dust monitoring undertaken daily by the site manager including recording wind strength and direction as outlined in the CEMP. Quantitative dust monitoring undertaken at intervals to support visual assessments.	Monitoring as per the CEMP
Unexpected contamination and spills	Excavation and material recovery	Management	Chemicals and fuels to be stored and handled in accordance with COSHH assessments. Management outlined in the CEMP and in accordance with the approved remediation strategy.	Documented in the CEMP.
		Technical	24 hour security across the wider site to prevent unauthorised access. Dedicated refuelling area for plant on an impermeable surface. Drip trays and spill kits to be available as per contractor's risk assessment and deployed. Spill kits to be available as per contractor's risk assessment and deployed. Spill kits to be available as per CEMP. Waste to be sheeted whilst awaiting collection for disposal off-site. The client's ground remediation consultant (Arcadis) have a watching brief over the works and will advise on temporary storage location and handling.	Source control
		Management	Management outlined in the CEMP.	Documented in the CEMP

Potential Hazard	Stage of Project Lifecycle	Control Type (management or technical)	Control Action	Control Location
Surface water runoff	Excavation and material recovery	Technical	Excessive run-off managed in line with the remediation strategy (provision of temporary drainage facilities).	Source control
Mud on roads resulting in dangerous driving conditions / nuisance to other road users	Excavation and material recovery	Management	Management outlined in the CEMP.	Documented in the CEMP
		Technical	Waste movement on and off-site is limited; the majority of excavated waste will be accepted, treated and processed within the site boundary. Site speed limit enforced (30 mph). All persons working on the site to undertake the Teesworks site induction Designated haul roads within site, and internal tarmac road network within wider Teesworks site. Distance to the Teesworks gatehouse and public road network is approximately 3km, during which it is unlikely that site derived mud will remain on tyres. Transportation of waste to be covered on public highway.	Source control
Injury / illness to unauthorised personnel	Excavation and material recovery	Management	Site specific security details to be outlined within the CEMP. Polluting liquids / chemicals stored in accordance with COSHH assessments to prevent unauthorised access and use.	Documented in the CEMP
		Technical	Wider Teesworks site is secure with 24 hour site security. Teeworks site is demarcated with 2.5 m high palisade fence to prevent unauthorised access. Waste/material stored on-site is not flammable. General waste skips covered and locked overnight.	Access control

Potential Hazard	Stage of Project Lifecycle	Control Type (management or technical)	Control Action	Control Location
Disturbance to nesting birds	Excavation and material recovery	Management	Management in accordance with the requirements of the Ecological Risk Assessment [5]. Management outlined in the CEMP.	Documented in CEMP
		Technical	Nesting bird check by an ecologist will take place within 48 hours of works commencing, or of works commencing on any new areas of the site. Should nesting birds be found to be present then a suitable buffer zone will be established around the nest(s) so that no harm or, if relevant disturbance, takes place. This will need to be repeated should new areas of the site be worked after the initial check.	Control of protected species
Trapped mammals in excavations	Excavation and material recovery	Management	Management in accordance with the requirements of the Ecological Risk Assessment [5]. Management outlined in the CEMP.	Documented in CEMP
		Technical	Measures to prevent otters of other mammals being trapped in excavations inc. covering small deep excavations outside of working hours and including a ramp into the excavation.	Control of protected species
Spread of invasive species	Excavation and material recovery	Management	Management in accordance with the requirements of the Ecological Risk Assessment [5]. Management outlined in the CEMP.	Documented in CEMP
		Technical	Prior to works commencing, a survey for invasive plant species will be undertaken by a suitably experienced ecologist. Should invasive species be found then a management plan, appropriate to the species identified, will be put in place prior to work commencing to prevent the spread of these species.	Control of protected species

6.1 Basal and Side Slope Engineering

The Hydrogeological Risk Assessment [4] and Earthworks Specification [10] demonstrate that no basal or side slope engineering is required to protect the environment from the deposit for recovery activity. Therefore, no outline engineering plan has been submitted as part of the permit application.

A stability risk assessment is not considered necessary for the site as:

- the backfill will be undertaken in accordance with the earthworks specification to provide a stable platform for future development;
- the excavation will not include any steep sides and will be only open for a short period of time;
- there are no existing slopes that are unstable and present a risk to the environment or people; and
- the works at the site do not include backfilling material into piles or mounds or into an excavation into the ground with steep side walls.

Stability associated with stockpiling will be managed under controls detailed within the CEMP.

6.2 Surface Water Management

Pollution control measures in respect to surface water management are detailed within Table 6-1. These measures will be outlined in the CEMP.

6.3 Post Closure Controls

The proposed end use of the site is a development platform that is to be suitable for subsequent commercial / industrial development by a future tenant.

The site will be visually monitored by the client and future tenant throughout the defect period as outlined in the NEC contract for the works; provisionally 12 months but dependant on the contract. It is likely that construction works will start at the site within the 12 months, at which point the management of the site and environmental risks associated with the construction and operation of the future facility will be managed by the tenant.

7. Amenity Monitoring

The following sections provide details of the monitoring that will be undertaken to confirm the pollution control measures are effective and that the risk of pollution from the permitted activities is low.

7.1 Odour in respect to NAPL

Pollution control measures in respect to odour management has been detailed within Table 6-1. Details of odour management will be described in the CEMP.

7.2 Dust

Pollution control measures in respect to dust management has been detailed within Table 6-1. Trigger monitoring is to include:

- Background dust monitoring undertaken prior to the start of works at four points around the site perimeter to determine baseline dust levels from the adjacent industrial/construction sites.
- Visual dust records undertaken daily by the site manager including recording wind strength and direction.
- Quantitative dust monitoring undertaken at intervals to support visual assessments.

Details of dust management and monitoring will be described in the CEMP, with reference to 'Guidance on the assessment of dust from demolition and construction, IAQM, January 2024'. Example locations for the monitoring points are detailed on drawing TSWK-STDC-FDR-ZZ-DR-C-0023 around the site perimeter. Should quantitative monitoring be triggered, the design of this will be in line with the relevant guidance.

7.3 Noise and Vibration

Pollution control measures in respect to noise and vibration management has been detailed within Table 6-1. Details of noise and vibration management will be described in the CEMP.

7.4 Weather Monitoring

The closest weather stations to the site are Loftus (approximately 19 km south east) and Carlton-in-Cleveland (approximately 22 km south). The prevailing wind direction is from the south west, with a high frequency of north and north east wind directions in spring. There are approximately 5 – 10 gales per year (where mean wind speed is greater than 34 knots). Total rainfall along the north east coast is less than 600 mm / year, with periods of prolonged rainfall associated with east or north east winds on the northern flank of depressions.

The site manager will use local Met office weather information to inform site activities and implementation of control measures (e.g. damping down to control dust).

7.5 Ground Gas

The types of materials accepted for backfill at the site are not considered to be ground gas generating and therefore ground gas monitoring is not proposed to be undertaken at the site. Any risk of ground gas from material recovery will be considered by the tenant as part of the future development.

7.6 Unexpected Contamination and Spills

Pollution control measures in respect to unexpected contamination and spills has been detailed within Table 6-1. Details of management of unexpected contamination and spills will be described in the CEMP in accordance with the approved remediation strategy.

7.7 Mud on Roads

Pollution control measures in respect to mud on the roads has been detailed within Table 6-1. Details of management of mud on haul road, Teesworks road network and public roads will be described in the CEMP.

7.8 Injury / Illness to Unauthorised Personnel

Pollution control measures in respect to injury / illness to unauthorised personnel has been detailed within Table 6-1. Details of security to the site from unauthorised personnel will be described in the CEMP.

7.9 Groundwater

Proposed groundwater trigger monitoring is outlined within the Arcadis Groundwater Sampling Plan [16], included as Appendix B.

7.10 Surface Water

Surface water receptors were discounted as detailed in Table 2-6 and therefore surface water monitoring at the site is not required.

Pollution control measures in respect to surface water runoff has been detailed within Table 6-1. Details of surface water management will be described in the CEMP.

7.11 Habitat and Protected Species

Based on the Ecological Risk Assessment [5], the following mitigation measures will be implemented to manage the risk to ecological receptors.

- Prior to works commencing, a survey by a suitably experienced ecologist is proposed, to identify invasive plant species across the site. Should invasive species be identified, a management plan would need to be put in place prior to work commencing. A nesting bird check is also proposed, to be undertaken within 48 hours of work commencing.

- Throughout the works, mitigation measures are required to prevent mammals being trapped in steep-sided excavations (e.g. ramps). Checks will be taken daily, throughout the works, by the site management team that mitigation measures are in place and working.

- Nesting bird check by an ecologist will take place within 48 hours of works commencing, or of works commencing on any new areas of the site. Should nesting birds be found to be present then a suitable buffer zone will be established around the nest(s) so that no harm or, if relevant disturbance, takes place. This will need to be repeated should new areas of the site be worked after the initial check.

These mitigation measures will be detailed within the CEMP.

7.12 Record Keeping

The risk assessment in Table 4-1 and pollution control measures in Table 6-1 identifies potential hazards where further monitoring or mitigation is required. Therefore, record keeping is required to document the implementation of the required pollution control measures as detailed within the CEMP.

8. References

[1] AtkinsRéalis, Waste Recovery Plan RCOX-ATK-ENV-FDRXX-RP-EN-000001.P1.05, 2025.

[2] AtkinsRéalis, Non-technical Summary and Additional Information MAM1-ATK-ENV-FDRXX-RP-EN-000001, 2025.

[3] AtkinsRéalis, Conceptual Site Model, Risk Assessment and Environmental Setting and Site Design Report MAM1-ATK-ENV-FDRXX-RP-EN-000002, 2025.

[4] Arcadis, Hydrogeological Risk Assessment 10047374-AUK-XX-XX-RP-ZZ-815-01-FCW_HRA, 2025.

[5] INCA, Ecological Risk Assessment INCA2024-14, 2024.

[6] AtkinsRéalis, Waste Acceptance Procedure MAM1-ATK-ENV-FDRXX-RP-EN-000003, 2025.

[7] AtkinsRéalis, Environmental Management System Summary MAM1-ATK-ENV-FDRXX-RP-EN-000004, 2025.

[8] Arcadis, “Phase 1 Contaminated Land Desk Study, Foundry Site - Potential HyGreen Plot, Teesworks, 10047374-AUK-XX-XX-DR-ZZ-735-01-HyG_Phase_1,” 2023.

[9] Standards for Highways, Manual of Contract Documents for Highway Works: Volume 1 - Specification for Highway Works: Series 600 Earthworks, 2017.

[10] Arcadis, Earthworks Specification 10047374-AUK-XX-XX-RP-ZZ-907-02-FCW, 2024.

[11] Arcadis, “Remediation Options Appraisal, Enabling Earthworks and Remediation Strategy Report 10047374-AUK-XX-XX-RP-ZZ-748-02-FCW_ROA&S.,” 2024.

[12] Corus Research, Development & Technology, “First Phase Reporting of the Site Protection and Monitoring Programme. 136323,” 2008.

[13] Allied Exploration & Geotechnics Ltd. , “Former SSI Steelworks Redcar - Advance Boreholes in SSI 1, Area C & D. Final Factual Report. 4145.,” 2018.

[14] Allied Exploration & Geotechnics Ltd., “The Former SSI Steelworks Redcar - Ground Investigation Contract - Priority Areas within SSI Landholdings Contract 1 and Contract 2 (Area A). Final Factual Report. 4143 & 4154.,” 2018.

[15] meteoblue, “meteoblue,” 2024. [Online]. Available: https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/redcar_united-kingdom_2639563. [Accessed 20 February 2024].

[16] Arcadis, “Foundry Central West Groundwater Sampling Plan 10047374-AUK-XX-XX-RP-ZZ-1035-01-Samp_Plan_FCE,” 2025.

[17] Environment Agency, “Control and monitor emissions for you environmental permit,” [Online]. Available: https://www.gov.uk/guidance/control-and-monitor-emissions-for-your-environmental-permit. [Accessed April 2024].

[18] Environment Agency, “Guidance: Risk assessments for your environmental permit,” 1 February 2016. [Online]. Available: https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit. [Accessed February 2024].

[19] Environment Agency, “Landfill operators: environmental permits,” [Online]. Available: https://www.gov.uk/guidance/landfill-operators-environmental-permits/plan-the-environmental-setting-of-your-site#conceptual-site-model. [Accessed March 2024].

APPENDICES

Appendix A. Qualitative Risk Assessment

Table A-1 below shows the qualitative risk matrix, in which the likelihood or probability of each pathway being realised is ranked against the severity of the consequences. The result is the relative risk classification, the results of which can inform the due diligence process and allow prioritisation of any further assessments or the implementation of additional risk management measures.

Table A-1 - Qualitative Risk Matrix

Risk Matrix		**Severity of Consequence**			
		Severe	**Medium**	**Mild**	**Minor**
Probability of pollutant linkage	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

Definitions of the risk classifications presented in the guidance are given in Table A-2 below.

Table A-2 - Risk Classification

Risk Classification	**Definition**
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified source, or there is evidence that severe harm to a designated receptor is currently happening.
High Risk	Harm is likely to arise to a designated receptor from an identified source.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified source. However, it is relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.
Low Risk	It is possible that harm could arise to a designated receptor from an identified source, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Appendix B. **Arcadis Groundwater Sampling Plan**

Monitoring and Maintenance Plan

Foundry Central West - Teesworks

FEBRUARY 2025

Prepared By:

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Prepared For:

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Version Control (optional)

Issue	Revision No.	Date Issued	Page No.	Description	Reviewed By
01	01	12/02/25			

Contents

Tables

Appendices

1 Introduction

This management document, compiled by Arcadis Consulting (UK) Ltd (Arcadis), provides details of the planned groundwater monitoring at the Foundry Central West (FCW) site including sampling methodology, along with the maintenance plan for the monitoring network. The planned groundwater monitoring is being conducted as requisite surveillance requested by the Environment Agency (EA) under a Deposit for Recovery (DfR) permit.

This document will be maintained by Arcadis through the duration of the active permit and updated accordingly based on any necessary changes that may occur.

2 Groundwater Monitoring Locations

Groundwater monitoring locations are presented in Arcadis document *10047374-AUK-XX-XX-CO-YY-1037-01-Foundry Central West Groundwater Criteria Memo.*

A total of four locations on the down hydraulic gradient site boundary and three on the up hydraulic gradient site boundary are proposed. The locations are presented on Figure 10047374-AUK-XX-XX-DR-ZZ-1036-02-FCW_Permit GW_Loc included as Appendix A with survey details in Table 1 and Table 2

Table 1:Down Hydraulic Gradient Monitoring Wells

Down Hydraulic Gradient Locations	Easting	Northing	Top of Well Pipe Elevation (meters above Ordnance Datum)
FOU-AUK-BH101S	455913.731	525679.282	7.817
A-BH18D	455802.102	525505.716	6.976
A-BH35S	455767.037	525264.537	7.079
B-BH26S	455901.227	525102.781	7.109

Table 2: Up Hydraulic Gradient Monitoring Wells

Up Hydraulic Gradient Locations	Easting	Northing	Top of Well Pipe Elevation (meters above Ordnance Datum)
FOU-AUK-BH102	456219.312	525559.572	7.191
FOU-AUK-BH103S	456143.281	525366.005	7.148
FOU-AUK-BH104	456060.623	525170.01	6.953

3 Monitoring Duration and Frequency

Details of the planned duration and frequency of monitoring are presented in Arcadis document *10047374-AUK-XX-XX-CO-YY-1037-01-Foundry Central West Groundwater Criteria Memo*.

4 Compliance Limits

Compliance limits are presented in Arcadis document *10047374-AUK-XX-XX-CO-YY-1037-01-Foundry Central West Groundwater Criteria Memo.* The groundwater memo also details the decision making process and actions that will be taken in the event of a breach of compliance limits.

5 Groundwater Monitoring Methodology

Groundwater monitoring will involve two tasks conducted concurrently as detailed below:

1. Assessment of the condition of the monitoring well
    a. Is the cover secure to prevent unauthorised access.
    b. Are the monitoring well headworks in good condition and accessible for sampling.
2. Groundwater Elevation Survey (See Arcadis' Technical Method Statement Groundwater and NAPL Monitoring (Appendix B)) modified to record to the top of the well pipe.
    a. Recording of depth to, and elevation of, groundwater.
    b. Recording of depth to base of the monitoring well.
    c. Not expected, but if present recoding of depth to, and elevation of, non-aqueous phase liquids (NAPL).
3. Collection of a groundwater sample for laboratory analysis (See Arcadis' Technical Method Statement Low Flow Sampling Using a Peristaltic Pump (Appendix B)). Samples will be collected from the mid-point of the well response zone (slotted section).

6 Storage, Preservation and Transport of Samples

Measures taken to ensure the quality and integrity of the groundwater samples, from collection to receipt of the samples by the laboratory is summarised below:

Task	Details
Storage	Containers as specified as required by the testing laboratory for each analyte will be used for the collection of samples.
Preservation	Filling of sample containers to minimise headspace and low storage temperature to minimise the potential for volatilisation and biodegradation of volatile compounds prior to analysis
Decontamination	Groundwater samples will be collected using dedicated disposable tubing in order to prevent cross-contamination.
Transport	Samples will be stored in dedicated sample boxes provided by the laboratory. Sample details and analytical requests will be recorded on the laboratory chain of custody form included with samples, prior to dispatching to laboratory for analysis. Samples will be dispatched to the laboratory on the day of sampling, where practicable.

7 Laboratory Analysis

Laboratory analysis of groundwater samples will be undertaken at a United Kingdom Accreditation Service (UKAS) & Monitoring Certification Scheme (MCertS) accredited (for selected chemical analysis) laboratory and an Arcadis approved supplier.

8 Quality Assurance and Quality Control (QA/QC)

Groundwater samples will be submitted to an Arcadis approved supplier and UKAS laboratory. The samples will be submitted with a chain of custody identifying the client, the Arcadis project reference, the Consultant / Project Manager, the nature of the sample (i.e., water) and the parameters to be tested.

Quality Assurance/ Quality Control (QA/ QC) at the laboratories will be carried out as part of their standard procedures. Arcadis' QA/ QC was conducted in line with in-house procedures, as part of our International Standards Organisation (ISO) 9001 and ISO 14001 accreditation.

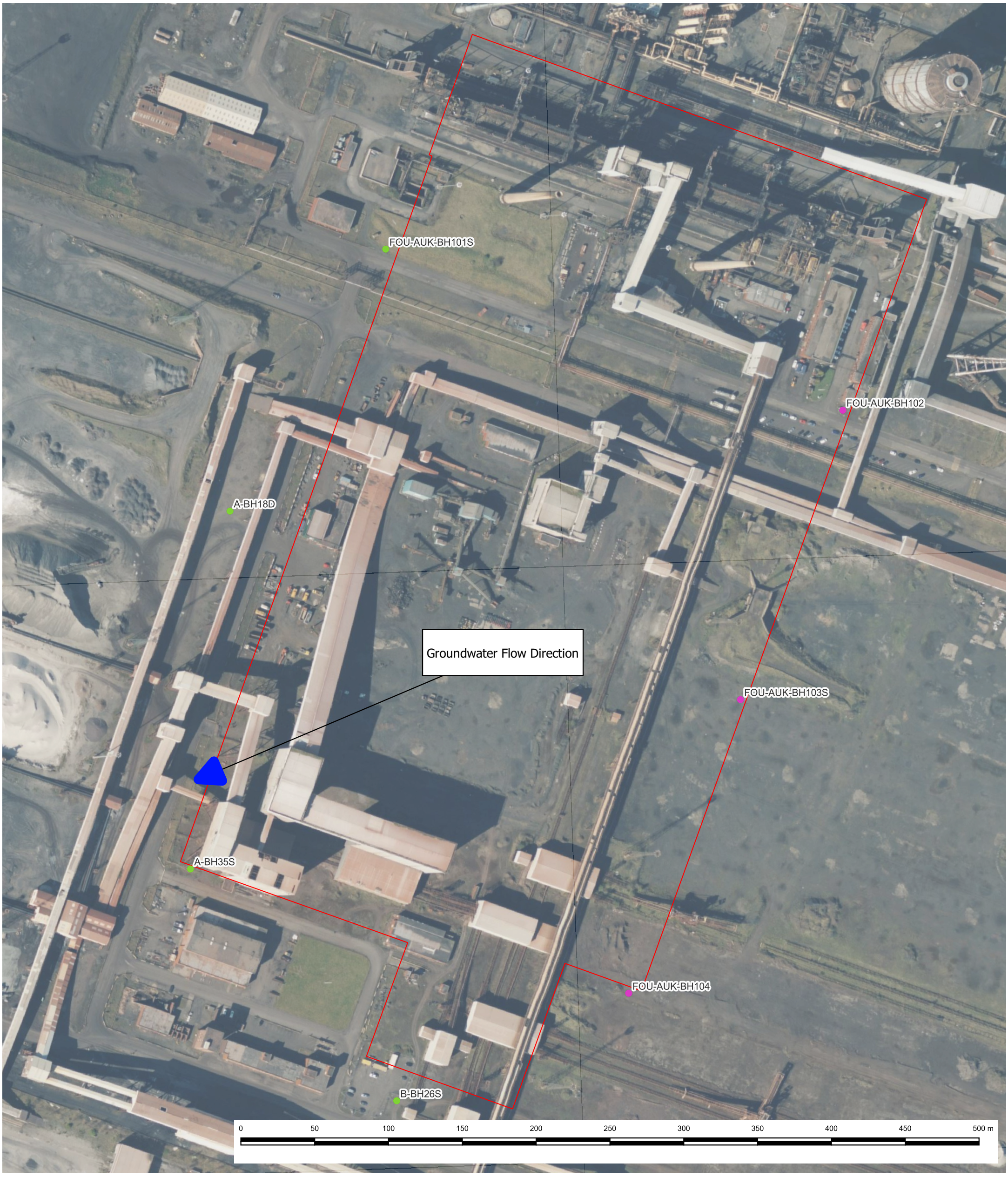
9 Monitoring Well Network Maintenance Plan

The following maintenance will be undertaken:

1. Monitoring well covers will be locked to prevent unauthorised access, and will be labelled with the location identity.
2. To reduce the risk of damage to the monitoring wells during the DfR activities the locations will be protected by hard barriers with high visibility / reflective surfaces. The location of the wells will be provided to the Principal Contractor and will be communicated to all plant operators working on site.
3. If during the tasks defined in Section 5 a monitoring well is noted to be subject to sediment build up following initial well development prior to the first sampling event, an attempt will be made to remove the sediment in line with Arcadis' Technical Method Statement monitoring well development (Appendix B).
4. Minor damage to monitoring wells (e.g. re-cement in a top hat cover) will be rectified before the following monitoring visit.
5. Wells damaged to the extent that that the tasks in Section 5 are no longer possible will be replaced by a new installation to the same design located within 5m of the original location. The data sets for the new and original location will be combined for future assessments.

Appendix A

10047374-AUK-XX-XX-DR-ZZ-1036-02-FCW_Permit GW_Loc



Legend

Monitoring Purpous

- Permit Compliance
- Up Hydraulic Gradient Surveillance

Base Maps

Bing

Redline

- Permit

Notes:

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CONTACT ARCADIS IN CASE OF ANY QUERIES.

N

Title: Permit Monitoring Locations

Site: Teesworks - Foundry Central West

Client:
South Tees Developement Corporation

Project:
10047374

Date: 23/01/2025
Drawn By: JALM
DRG No: 10047374-AUK-XX-XX-DR-ZZ-1036-02-FCW_Permit GW_Loc

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Appendix B

Arcadis Technical Method Statements

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ENVIRONMENT – TECHNICAL METHOD STATEMENT

Task

Groundwater and non-aqueous phase liquid (NAPL) monitoring

Equipment

- Interface probe (groundwater and NAPL monitoring) or dip meter (groundwater monitoring)
- Groundwater and NAPL recording sheet
- Decon-90 or comparable cleaning solution and paper towels (e.g. “blue roll”)
- Ratchet set and screwdriver
- Marker paint

Steps

(1) Prepare the monitoring well

Confirm the monitoring well number against the site plan and fill in initial details on recording sheet (e.g. location number, weather etc). If on disused site, the location can be marked using marker paint. Unscrew the monitoring well cover and well bung and set to one side. The screwdriver may be used to carefully prise open the lid, and to clear the screw holes from dust/stones if needed.

WATCH POINT! The screws and washers should be kept in a safe location ready for re-use on completion of the monitoring.

(2) Undertake the monitoring

Switch on the interface probe or dip meter, and lower gently into the monitoring well.

If using a dip meter, a continuous beep means that the probe has encountered water, either at the air-water or NAPL-water interface. The probe should be raised and lowered slightly to confirm the depth at which the probe beep is triggered. Using the monitoring well cover half placed across the monitoring well, or any other flat object which create a surface level with the ground, read the depth on the probe measure at which the beep first occurs from the centre of the well directly over the well pipe, to the nearest 1mm. Record the depth to water measurement on the recording sheet. Continue to lower the dip meter to the base of the well. Where resistance is met, representing accumulated fines or the base of the monitoring well, record the depth to base in the same way as for the depth to groundwater.

If using an interface probe, a continuous beep means that the probe has encountered NAPL, either at an air-LNAPL or water-DNAPL interface. Upon hearing a continuous beep, the probe should be raised and lowered slightly to confirm the depth at which the probe beep is triggered. Using the same methodology outlined above, record the depth to LNAPL (if present) on the recording sheet to the nearest 1mm. Continue to lower the probe gently until an intermittent beep is heard (depth to water). Record the depth to water on the recording sheet. Continue to lower the interface probe to the base of the well. If a continuous beep is encountered, DNAPL may have been encountered within the base of the monitoring well. If this occurs, the probe should be raised and lowered slightly to confirm the depth at which the probe (continuous) beep is triggered and the depth to DNAPL recorded. Continue to lower the probe to the base of the monitoring well. Where resistance is met, representing accumulated fines or the base of the monitoring well, record the depth to base in the same way as for the depth to groundwater.

WATCH POINT! For raised covers record readings the same way as Flush covers. Recording DTP / DTW and DTB from top of the cover, from the centre directly above the well pipe. Top hat cover height relative from ground level can then be subtracted following this measurement.

Images

ENVIRONMENT – TECHNICAL METHOD STATEMENT

Steps

(3) Complete monitoring

Remove the dip meter or interface probe from the monitoring well, using Decon-90 and a paper towel (or other suitable cleaning method) to clean the probe measure and probe itself. Replace the well bung and well cover, and secure firmly.

WATCH POINT! If using a dip meter, if the probe tape or probe is highly odorous or there is visual evidence of contamination (e.g. sheen) when removed from the monitoring location, NAPL may be present. Contact the Project/ Task Manager to determine whether an interface probe should instead be used.

(5) Quality control

Ensure that paper towels are disposed of appropriately. Ensure that the probe and attached tape measure is appropriately decontaminated before use on a new monitoring location.

NOTE – some interface probes operate differently, if in doubt, please check the tone emitted in a control solution of water to ensure that a solid tone is emitted as opposed to an intermittent tone.

Images

ENVIRONMENT – TECHNICAL METHOD STATEMENT

Task
Low-flow groundwater sampling using a peristaltic pump

Equipment
- Peristaltic pump (with internal battery or external supply)
- Multi-parameter probe and calibration solutions
- Oil-water interface probe or dip meter
- 4x6 mm low-flow tubing
- Silicone tubing
- Laboratory-prepared sample containers
- Waste purge water storage (bucket or 25 litre barrel) and measuring jug
- Arcadis low flow sampling recording sheets
- Appropriate equipment for cutting low-flow tubing
- Borehole opening equipment

Eijkelkamp Peristaltic Pump 12 VDC Standard Manual -
https://www.eijkelkamp.com/files/media/Gebruiksaanwijzingen/EN/m2-1225eperistalticpump.pdf

Before heading to site, contact sampling laboratory to order sample containers (number and type varies dependent on compounds investigating). Samples should be scheduled to be collected daily where possible.

WATCH POINT! The peristaltic pump is not watertight, therefore, during use the top portion of the pump should be covered if undertaking pumping in wet / adverse conditions.

Steps

(1) Calibrate the multi-parameter probe for dissolved oxygen (DO), electrical conductivity, pH and Oxidation-Reduction Potential (ORP), using appropriate calibration solutions and water (as per manufacturer's instructions).

WATCH POINT! Make sure calibration solutions are in date. Care should be taken with the cable between the multi-parameter probe and handset to prevent damage to the cable. Calibration solutions can be acidic or basic and therefore should not be mixed. The waste calibration solutions should be collected in a drum and are not to be discharged to ground.

(2) Prepare work area around monitoring well, as detailed on traffic management plan / in Health and Safety Plan (HASP).

(3) Measure depth to NAPL, if present and initial depth to water and depth to base of well. Refer to Technical Method Statement *Groundwater and NAPL Monitoring* for details.

WATCH POINT! If NAPL is encountered in the monitoring well, confirm with Project Manager or Task Manager before continuation of groundwater sampling.

(4) Measure out and cut low-flow tubing to pre-determined depth or to halfway through the water column *i.e.* half-way between the depth to water and depth to base or monitoring well. The pipe inlet MUST be within the slotted section of the well.

WATCH POINT! Prior to cutting tubing make sure that the sampling depth is within the screened section of the well by reference to BH logs or previous data. If needs be, adjust the tubing length.

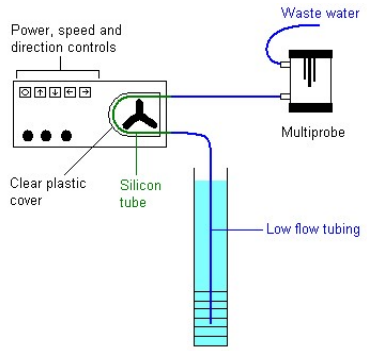
(5) Ensure the peristaltic pump is turned off. Undo the bolts holding the clear cover of the peristaltic pump and remove the cover. Place a length of silicon tubing around the rolling heads of the peristaltic. Replace the clear cover and associated bolts. Trim silicon to suitable length.

WATCH POINT! Water that enters the covered area beneath the plastic may impact the pumps ability to draw up water. If there is restricted flow, this area should be tried and pumping continued.

(6) Connect low-flow tubing to silicon tubing.

(7) Lower the low-flow tubing down the well until it is fully extended.

Image



Set up of peristaltic pump

Peristaltic pump

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ENVIRONMENT – TECHNICAL METHOD STATEMENT

Task

Low-flow groundwater sampling using a peristaltic pump.

Steps (Continued)

WATCH POINT! If it is difficult to get the tubing to the required depth add a short length (~1") of silicon tubing to the end of the low flow tube, this will help stop it getting stuck. Tubing should only be weighted as a last resort, and weight objects should be thoroughly cleaned before use, and in between each well, and attached to tubing using cable ties or similar (not gaffa tape).

(8) Connect the other end of the silicon tubing to the bottom of the multiprobe flow cell using a separate length of low flow tubing.

(9) Purged water from the top outlet of the flow cell should be directed into a measuring jug using another length of low-flow tubing.

(10) Connect line into flow cell of a multi-parameter probe and record DO, conductivity, pH and ORP readings every 5 minutes for at least 30 minutes or until DO, conductivity, pH and ORP readings stabilise, as detailed below, over three readings. If using a Troll or SmartTroll probe the stabilisation parameters should be pre-set as follows:

- DO +/- 10% of reading or 0.2 mg/l, whichever greater
- Temp +/- 0.2 degrees C
- pH +/- 0.2 pH Units
- +/- 20 mv +/- 3% of reading, whichever is greater

Also monitor depth to water throughout purging, to observe if draw-down in the monitoring well is occurring.
Measure and record the volume of purge water using the measuring jug, record its visual/ olfactory appearance and store in a drum/barrel, to be disposed of it in accordance with the site's procedures.

WATCH POINT! If significant drawdown is observed and it is unlikely that the well can be pumped until the parameters stabilize and then have enough water remaining to sample, obtain a grab sample from the tubing prior to the flow cell and make a note on your site notes.

WATCH POINT! If poor water retrieval is experienced, this is likely due to high sediment content in the zone that is being pumped. Attempt to elevate the depth that is being pumped at or shake the tubing to release the sediments. If after both of these tasks a different methodology, bailers or foot pump, may be required to obtain a sample.

(11) Sample the groundwater directly from the water return tubing (disconnect line from flow cell) into the laboratory provided containers. Seal the containers with no head space (for vials) and minimum head space for bottles. Place samples in dedicated cool box with cooling aids.

WATCH POINT! Water samples must be collected from the tubing before the flow cell, not after, to prevent cross contamination from water previously run through the flow cell itself.

WATCH POINT! For some testing, water samples will be required to be pre-filtered prior to sending to the labs.

(12) Turn off the peristaltic pump and dispose of all tubing, both low flow and silicon, which carry groundwater from the well to the flow cell. Measure and record the final depth to water. Replace the well bung and well cover, and secure firmly.

WATCH POINT! Waste plastic and PPE should be separated from other waste materials and be disposed of in a manner consistent with the start up notes and current waste legislation. All generated waste that is transported back to field services must be accompanied by a signed waste transfer note. Refer to Standard Operating Procedure on Waste Management for further information.

(13) Once monitoring is complete, fill the multi-parameter probe with water and store on the container.

Image

ENVIRONMENT – TECHNICAL METHOD STATEMENT

Task
Groundwater monitoring well development

Equipment
- Toolkit and appropriate keys to open monitoring well covers
- Interface probe
- Well development/purging equipment (surge block, bailer, pump or inertial pump tubing and valve)
- Water containers for developed/purged water (where applicable)
- Multiprobe (optional)

Steps

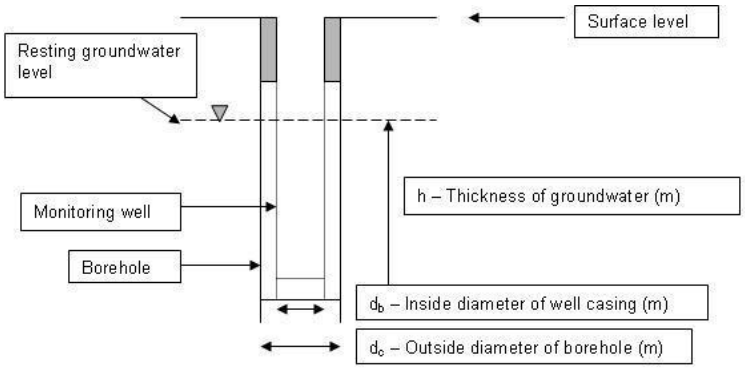
(1) Set up

Open monitoring well cover. If the top casing surrounding the monitoring well is water logged, all standing water should be bailed out prior to removing the well cap. Prior to monitoring well development the static water level and non aqueous phase liquid thickness (if present) should be measured using Technical Method Statement for groundwater and NAPL monitoring.

WATCH POINT! If a significant quantity of non-aqueous phase liquid is present (greater than 2-3mm) the well should not be developed, thus preventing the mobilisation of contaminants into solution or the smearing of product.

(2) Preparatory calculations

In order to give an indication of the volume of water to be removed there are two options, as detailed below:



Option A
The well volume is calculated based on the well diameter using the following equation:

$$\text{Well Volume} = \pi \cdot d_b^2 \cdot h / 4$$

Calculations of volume of water within the well for standard well diameters and volumes for developing and purging are included with this method statement.

Option B
Where requested to develop/purge the whole volume of borehole, the total borehole and well volume is calculated based on borehole diameter and makes allowance for the filter pack porosity, using the following equation:

$$\text{Well Volume} = [\pi \cdot d_b^2 \cdot h / 4] + \{[\pi (d_c^2 - d_b^2) / 4] \cdot \varphi \}$$

Where φ is the porosity of the filter pack.

Image

Steps

(3) Monitoring well development

The process of well development aims to remove fine sediments from the borehole and from the aquifer along the screened section of the well. The development process will assist with limiting the quantity of sediment entering the borehole during future sampling events and should assist with the collection of a sediment free groundwater sample representative of the aquifer conditions. Well development should, ideally “stress” the well and aquifer. This is typically achieved by pumping in surges, adjusting the depth of the pump and/or agitation with a surge block or inertial pump. The rate of pumping must be greater than that proposed for the subsequent groundwater monitoring.

Monitoring well development should continue until the water is visibly clean and / or of constant quality (e.g. constant electrical conductivity). As an initial indication monitoring well development should involve the removal of approximately 10 times the calculated volume of water in the well. In cases where the monitoring well is developed until dry, monitor recharge of groundwater to assess viability of 10 times calculated volume removal, and discuss with the Project Manager to determine appropriate development volumes.

The development procedure will be achieved by either:

- Pumping with an electrical submersible pump.
- Pumping with an inertial pump.
- Air lifting.
- Bailing.

WATCH POINT! All development should target the full screened section of the borehole, and in many cases should attempt to remove any fines that may have entered and settled at the bottom of the borehole. Where fines are present, a combination of pumping and surging (using a surge block) may be appropriate.

(4) Quality Assurance / Quality Control

Well development is to be carried out using disposable equipment or fully decontaminated equipment, care should to be taken to ensure that development equipment does not come into contact with any potentially contaminated surfaces that may result in the cross-contamination of groundwater. Every effort must be taken to avoid cross contamination of the monitor wells.

Water should be collected and disposed of in line with the Standard Operating Procedure and project Start-up Notes.

In some cases, developing of wells may be required where NAPL has been reported. If required, a procedure for separation of product and minimising the potential for mobilisation or smearing of contamination must be developed, and agreed with the Project or Task Manager.

Image

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Supplementary Information

1" Boreholes

Water column thickness (cm)	Volume of water (cm3)	Volume for Development (Litres)	Volume for Purging (Litres)
1	5.07	0.05	0.02
2	10.13	0.10	0.03
3	15.20	0.15	0.05
4	20.27	0.20	0.06
5	25.34	0.25	0.08
6	30.40	0.30	0.09
7	35.47	0.35	0.11
8	40.54	0.41	0.12
9	45.60	0.46	0.14
10	50.67	0.51	0.15
50	253.35	2.53	0.76
100	506.71	5.07	1.52

2" Borehole

Water column thickness (cm)	Volume of water (cm3)	Volume for Development (Litres)	Volume for Purging (Litres)
1	20.27	0.20	0.06
2	40.54	0.41	0.12
3	60.80	0.61	0.18
4	81.07	0.81	0.24
5	101.34	1.01	0.30
6	121.61	1.22	0.36
7	141.88	1.42	0.43
8	162.15	1.62	0.49
9	182.41	1.82	0.55
10	202.68	2.03	0.61
50	1013.41	10.13	3.04
100	2026.83	20.27	6.08

4" Borehole

Water column thickness (cm)	Volume of water (cm3)	Volume for Development (Litres)	Volume for Purging (Litres)
1	81.07	0.81	0.24
2	162.15	1.62	0.49
3	243.22	2.43	0.73
4	324.29	3.24	0.97
5	405.37	4.05	1.22
6	486.44	4.86	1.46
7	567.51	5.68	1.70
8	648.59	6.49	1.95
9	729.66	7.30	2.19
10	810.73	8.11	2.43
50	4053.66	40.54	12.16
100	8107.32	81.07	24.32

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