Date: 29th January 2025
Ref: 17-403-L2-1

Step Places
Unit 4
Royal Mills
17 Redhill Street
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DETAILED CONTROLLED WATERS RISK ASSESSMENT RYEBANK ROAD, CHORLTON

1. INTRODUCTION

1.1. BACKGROUND AND OBJECTIVES

E3P has been commissioned by Step Places to carry out a comprehensive controlled waters risk assessment for the proposed residential development located north of Ryebank Road and Longford Road, Chorlton, Manchester, M21 9LU.

This report will build upon the previous Site Investigation and Tier 2 qualitative controlled water risk assessments carried out by E3P, further assessing the risks to controlled waters from identified areas of dissolved phase contamination within the soil and groundwater.

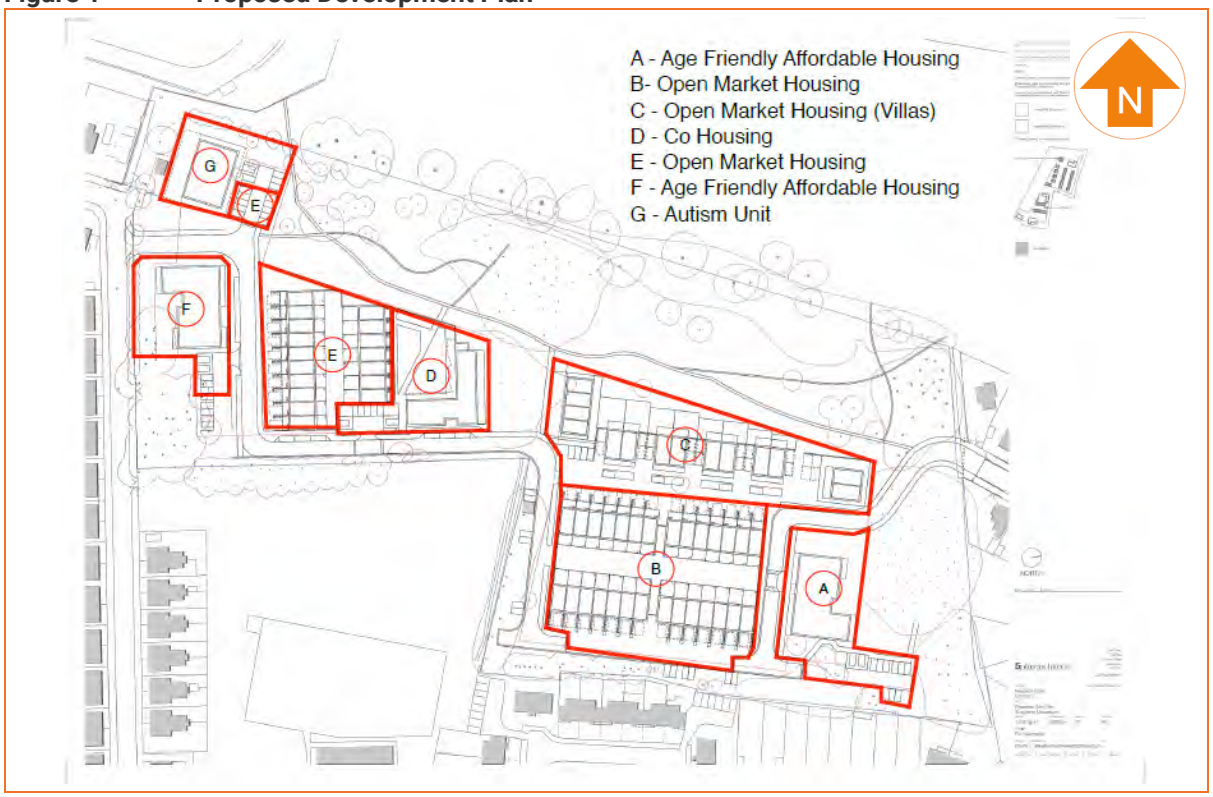
Site-specific screening criteria will be developed as part of the assessment to assess the potential for pollutant compounds of concern to present a risk to the identified critical receptor.

The controlled waters risk assessment will be summarised within this document.

1.2. PROPOSED DEVELOPMENT

E3P understands that the proposed development will comprise a residential development that includes access, car parking provision, landscaping, sustainable drainage features, and other associated work. Drawing 17-403-002 (Appendix I) identifies the proposed development layout, and a snapshot is shown in Figure 1.

Figure 1 Proposed Development Plan



1.3. PREVIOUS REPORTS

The following previous reports have been completed for the site and should be read in conjunction with this report:

Table 1 Previous Reports

AUTHOR	TITLE / REFERENCE	CLIENT	DATE
E3P	Phase I Geoenvironmental Site Assessment (Report Ref: 13-533-R1-2)	Manchester Metropolitan University	March 2020
E3P	Phase II Geoenvironmental Site Assessment (Report Ref: 13-533-R2-2)	Manchester Metropolitan University	March 2020
E3P	Human Health Risk Assessment Report (Report Ref: 13-533-R3-3)	Manchester Metropolitan University	August 2020
E3P	Ground Gas and Vapour Assessment Report (Report Ref: 13-533-R4-1)	Manchester Metropolitan University	October 2020
E3P	Remediation and Enabling Works Strategy (Report Ref: 13-533-R5-1)	Manchester Metropolitan University	October 2020
E3P	Phase II Geoenvironmental Site Assessment (Report Ref: 17-401-R1-3)	Step Places	Nov 2024

2. CONTROLLED WATERS CONTAMINATION RISK SUMMARY

2.1. CONTROLLED WATERS ASSESSMENT

The Tier II controlled waters risk assessment indicates that the data exceeds the EQS and DWS values for the following compounds:

Table 2 Summary of Controlled Waters Risk Assessment

EXCEEDANCE OF EQS	EXCEEDANCE OF DWS
Heavy Metals - Chromium VI (L and GW) - Chromium III (GW) - Copper (L and GW) - Total Cyanide (L and GW) - Lead (L and GW) - Nickel (L and GW) - Zinc (L and GW) **PAHs** - Naphthalene (GW) - Anthracene (GW) **TPHs** - TPH C5-C7 Aromatic (GW) - TPH C8-C10 Aromatic (GW) - TPH C10-C12 Aromatic (GW) **VOCs/SVOCs** - Trichloromethane (GW) - Benzene (GW) - p & m Xylene (GW) - o-Xylene (GW) - Phenol (GW)	**Heavy Metals** - Arsenic (L and GW) - Total Cyanide (GW) - Lead (L and GW) - Nickel (GW) **PAHs** - Naphthalene (GW) **TPHs** - TPH C5-C7 Aromatic (GW) - TPH C8-C10 Aromatic (GW) - TPH C10-C12 Aromatic (GW) - TPH C12-C16 Aliphatic (GW) **VOCs/SVOCs** - Benzene (GW)

Notes
L = Leachate sample

GW = Groundwater sample

The assessment indicates that the majority of exceedances relate to groundwater when compared against EQS values, however some exceedances in groundwater have also been noted when compared to the higher DWS values.

In a groundwater risk assessment, EQS (Environmental Quality Standards) and DWS (Drinking Water Standards) are both important benchmarks used to evaluate water quality in relation to potential contamination. However, they serve different purposes and are applied in distinct contexts.

EQS values are established to protect the broader environmental health of aquatic ecosystems, including surface water and groundwater, with a focus on preserving biodiversity, ecological balance, and overall environmental quality. These values are set for specific pollutants in different environmental media (such as water, air, and soil) to ensure that water quality does not pose a risk to the environment. EQS values are often used to assess risks to aquatic life, flora, and fauna, ensuring that pollution levels do not exceed thresholds that would harm the ecosystem.

On the other hand, DWS values are designed to protect human health by establishing the maximum allowable concentrations of specific contaminants in drinking water. These standards focus on ensuring that water used for human consumption is safe and does not pose health risks, such as from toxic chemicals, heavy metals, or pathogens.

EQS values are focused on protecting the broader environmental quality, while DWS values are more concerned with safeguarding human health through safe drinking water.

For the site at Ryebank, Chorlton, there is no potable water abstraction in the area. Since there is no potential for human consumption of the groundwater, there is no complete pollutant linkage and the risk to human health is not a concern. EQS values are more relevant for assessing environmental risks to local ecosystems.

Arsenic has been identified above the DWS values within six locations across the four monitoring visits with a maximum concentration of 28 ug/kg recorded within WS205.

Chromium (III) was identified above the EQS values during the first monitoring visit however no further exceedances were noted during the 2024 monitoring.

Exceedances in copper have been identified when compared against EQS values within WS101, WS110, CP101, CP102, WS202 and WS205 during the first two monitoring visits. No exceedances were recorded within the final two visits.

Total cyanide has been recorded above both EQS and DWS values during the first monitoring visit within WS101, WS110, CP101 and CP102, however no exceedances have been recorded with the majority of samples indicated levels are below LOD.

Lead has been identified above EQS values during all monitoring visits however a number of exceedances are marginal (1.30ug/kg - 2.4ug/kg). Concentrations of lead within WS110 are recorded above both EQS and DWS values with the maximum recorded concentration on site (16ug/kg).

Elevated levels of Nickel have been identified when compared against EQS values within WS101, WS110, CP101, CP102, WS202 and WS205 during the first two monitoring visits. Concentrations within WS110 are also noted to exceed the higher DWS values with a maximum concentration of 22 ug/kg.

No exceedances of cadmium, chromium (VI), selenium or mercury have been identified when compared against both EQS and DWS values.

Zinc has been identified above EQS values during the first and last monitoring visits within WS101, WS110, CP101, CP102, CP201, CP202, CP203 and CP204. The maximum concentration of 530 ug/kg has been recorded within both CP201 and CP204 which is located within the natural response zone. The remaining elevations of zinc are noted within Made Ground response zones. The concentrations encountered during visit 4 are significantly higher than the initial monitoring results.

Elevated levels of manganese have been identified above EQS and DWS values within CP201, CP202, CP203 and CP204 with a maximum concentration of 880ug/kg within CP204. Exceedances appear to be associated with deep groundwater as no exceedances have been recorded within shallow monitoring installations.

pH levels in excess of 10 have been identified within CP101 and CP102 during the first monitoring visit in 2019. pH levels within samples from the 2024 monitoring are all within the range of 6-9.

Elevated levels of Naphthalene have been identified within 8 locations when compared against EQS values, five of which also exceed the higher DWS values with a maximum recorded concentration of 270ug/kg within CP204 (natural response zone). The majority of identified exceedances are recorded within the deeper monitoring locations within the Made Ground.

Anthracene has been identified above EQS values within WS101, CP201, CP204, WS201 and WS202 with a maximum concentration of 1ug/kg. There are no exceedances when compared against the higher DWS values.

There are no exceedances identified against EQS or DWS values for benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(123-cd)pyrene, fluoranthene and benzo(ghi)perylene with all concentrations recorded below the LOD.

No elevated levels of Aromatic TPH C7-C8 or C16-C35 have been identified within any of the groundwater monitoring visits. Elevated levels of Aromatic TPH C5-C7 have been identified within CP101 (EQS and DWS) and CP102 (EQS) during the first monitoring visit. No exceedances for C5-C7 were encountered during the 2024 monitoring.

Aromatic TPH C8-C10 has been identified above EQS values within WS201, WS202, CP202 and CP203 during the monitoring visits in 2024. Concentrations encountered in WS202, CP202 and CP203 also exceed the higher DWS values.

Aromatic TPH C10-C12 has been identified above EQS levels within CP101, CP102, WS201, WS202, CP201, CP202, CP203 and CP204. Levels within WS201, WS202, CP202 and CP203 also exceed the higher DWS values. Elevated levels were identified during both the 2019 and 2024 monitoring visits within both Made Ground (CP101, CP102, WS201, WS202, CP202 and CP203) and natural response zones (CP201 and CP204).

Aromatic TPH C12-C16 has been identified above the DWS value on three monitoring visits within CP101, WS201 and CP203. It should be noted that a EQS value is not available for this determinant.

No elevated levels of Aliphatic TPHs have been identified within groundwater samples during the monitoring visits undertaken. All levels were recorded below the limit of detection.

VOCs and SVOCs have been identified within groundwater within seven locations on site and are typically noted within monitoring installations with Made Ground response zones. The exception of this is CP201

(natural response zone) where Benzene has been identified above both DWS and EQS levels on the fourth monitoring visit.

Toluene and Ethylbenzene are recorded below both the EQS and DWS values on all monitoring visits. Tetrachloroethylene (PCE), trichloroethylene (TCE), trichlorobenzene and vinyl chloride (VC) are all recorded below the limit of detection (<1.0ug/kg). Trichloromethane (TCM) has been recorded above the EQS value within CP101 during the first monitoring visit. No elevated levels of TCM were recorded during the 2024 groundwater monitoring.

o-, p- & m-Xylene have been identified above the EQS values within CP202 and CP203 during the 2024 monitoring visits. There are no elevated levels of o-, p- & m-xylene when compared against DWS values.

Elevated levels of Phenol were identified during the first monitoring visit when compared against EQS values. No further exceedances have been identified in the 2024 monitoring.

Groundwater samples with SVOC and VOC values recorded above the limit of detection (LOD) where no GAC is available have been summarised in Table 3.

Table 3 Summary of SVOCs and VOCs identified above the LOD

DETERMINANT	UNIT	ASSESSMENT CRITERIA	N	MC	LOC. OF EX	PL	ASSESSMENT
2,4-Dimethylphenol	µg/l	No GAC available	16	2.0 38 76 2.5 3.9	WS110 CP101 CP102 CP201 CP203	4	Further Assessment
Dibenzofuran	µg/l	No GAC available	16	0.97 4.7 1.7 7.1 4.1 1.2 1.0 2.2 2.5	WS101 WS202 CP201 CP204 WS201 WS202 CP201 CP202 CP203	4	Further Assessment
Carbazole	µg/l	No GAC available	16	3.2 1.7 7.5 13 14 8.3 1.1 2.1 5.2 8.0	CP101 CP102 WS202 CP201 CP204 WS202 WS205 CP201 CP202 CP203	4	Further Assessment
Chlorobenzene	µg/l	No GAC available	16	4.9 1.3 25 5.9	CP203 CP201 CP202 CP203	4	Further Assessment
Isopropylbenzene	µg/l	No GAC available	16	1.3 8.3 16 4.3 15	CP201 CP203 CP201 CP202 CP203	4	Further Assessment
N-Propylbenzene	µg/l	No GAC available	16	5.8 11 2.6 11	CP203 CP201 CP202 CP203	4	Further Assessment
1,2,4-Trimethylbenzene	µg/l	No GAC available	16	1.9 1.7 40 19	CP101 CP102 CP201 CP203	4	Further Assessment
1,3,5-Trimethylbenzene	µg/l	No GAC available	16	3.2 19 18 33	WS202 CP203 CP202 CP203	4	Further Assessment
Sec-Butylbenzene	µg/l	No GAC available	16	2.1 2.9	CP201 CP203	4	Further Assessment
4-Isopropyltoluene	µg/l	No GAC available	16	2.3 1.7 1.7 4.1	WS202 CP203 CP202 CP203	4	Further Assessment

DETERMINANT	UNIT	ASSESSMENT CRITERIA	N	MC	LOC. OF EX	PL	ASSESSMENT
2-Methylnaphthalene	µg/l	No GAC available	16	1.6 4.2 0.56 11 3.6 1.2 3.4 6.6	WS202 CP201 CP203 CP204 WS201 WS202 CP202 CP203	4	Further Assessment

Where VOCs are recorded within groundwater which do not have an appropriate GAC, they are initially included as a potential risk. Further assessment is required to understand the potential solubility, mobility and associated risk to the identified controlled water receptors. The majority of concentrations recorded are only marginally higher than the LOD and are therefore considered a low risk.

2.1.1. DISCUSSION OF CONTROLLED WATERS RISK ASSESSMENT

The majority of exceedances identified are in groundwater obtained from monitoring wells with response zones in the Made Ground. Elevated levels of heavy metals, PAHs, and TPHs have been identified within CP201 and CP204, which both have monitoring wells installed within the natural clay underlying the deep Made Ground. VOCs and SVOCs have also been detected in groundwater samples from wells with response zones in both Made Ground and natural deposits.

Receptor – Underlying Principal Aquifer and Secondary A Superficial Aquifer

Elevated levels of heavy metals, PAHs, TPHs, and Benzene have been identified within groundwater samples, exceeding Drinking Water Standards (DWS). It is understood that these elevated levels are associated with perched water within the Made Ground in the infilled clay pits. Water samples taken from both deep and shallow monitoring wells indicate contamination exceedances, making it unfeasible to determine a specific source; rather, the impact is understood to be widespread within the infilled clay pits.

Low-permeability clay has been encountered beneath the Made Ground within the infilled clay pits, providing some protection to the underlying principal aquifer. BGS borehole records indicate that the bedrock (principal aquifer) is located at a depth of 27 m bgl 600 m north, therefore there is likely to be a significant cover of low-permeability clay, which reduces downward migration. However, exceedances identified in groundwater samples taken from natural response zones (CP201 and CP204) beneath the infilled clay pits indicate that some downward migration may be occurring on-site.

Further assessment will be required if piled foundations are utilised to ensure no preferential pathways are created, which could increase the risk to the underlying principal aquifer.

The northern part of the site comprises glaciofluvial superficial deposits, classified as a Secondary A aquifer, which may be in direct contact with the Made Ground within the infilled clay pits. Further investigation will be needed in the north to confirm the presence of any shallow, low-permeability clay deposits that could prevent lateral migration to the adjacent Secondary A aquifer.

The site, a former clay pit in Manchester, has been infilled with ash-type materials, and residual polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPHs) have been identified within the ground. At present, the site is entirely unsurfaced, allowing unrestricted infiltration of rainfall into the ground. This poses an increased risk of contaminant mobilisation, leaching, and transportation into the groundwater system.

Manchester experiences an average annual rainfall of approximately 900 mm (0.9 m). On an unsurfaced site of one acre (4046.86 m^2), this results in an estimated infiltration volume of 3642.17 m^3 per year. Following the proposed development, where 60% of the site will be made impermeable, infiltration will be reduced by the same proportion. The remaining 40% of the site will account for only 1456.87 m^3 of infiltration per year, resulting in a reduction of 2185.3 m^3 per year per acre.

This reduction in infiltration has important implications for groundwater risk. The current high rate of infiltration facilitates the downward movement of water through the contaminated fill, increasing the risk of contaminant mobilisation and dissolved-phase transport into the groundwater. Post-development, the introduction of impermeable surfacing on 60% of the site will significantly reduce infiltration, lowering the hydraulic connectivity between surface water and groundwater. This reduction will minimise the volume of water available to dissolve and mobilise contaminants, thereby decreasing the potential for their leaching and migration into deeper aquifers.

The introduction of impermeable surfacing is a pragmatic engineering control that mitigates groundwater contamination risks by reducing infiltration and the subsequent mobilisation of PAHs and TPHs. Lower infiltration rates will confine contaminants closer to the surface, where they can be more effectively managed through additional surface-level remediation techniques.

The proposed reduction in infiltration, achieved by rendering 60% of the site impermeable, provides a practical remediation solution. It significantly mitigates the risk of contaminant transport into groundwater, aligning with sustainable development principles and ensuring compliance with environmental regulations.

Receptor – Surface Water (Culverted Longford Brook/Nico Ditch)

Elevated levels of heavy metals, TPHs, PAHs, and VOCs/SVOCs have been identified in groundwater samples when compared with Environmental Quality Standards (EQS). Exceedances have been noted in both shallow and deep monitoring wells installed within Made Ground across the site, indicating an association with perched water within the infilled clay pits. It is not feasible to determine a specific source; the impact is considered widespread within the infilled clay pits.

Where shallow groundwater contamination is present, there is potential for lateral migration to the on-site culverted brook along the Nico Ditch. Typically, infiltration leads to downward migration of mobile phase contamination through leaching, meaning contamination will migrate away from the onsite culvert, although some lateral migration is possible. The construction and exact location of the culverted watercourse are currently unknown due to limited investigation in this area. It is understood that the Nico Ditch remained intact during the extraction of clay for brick works because of its historical importance; however, this has not been confirmed. If low-permeability clay deposits are still present in the location of the Nico Ditch and culverted brook, they will provide some protection against contamination migration. It is believed that the Nico Ditch is present at the near surface and not towards the base of the infilled clay pits, therefore it is not likely to be within hydraulic connectivity of the infiltration and dissolved phase impact leached from the clay pits. Additionally, depending on the construction of the culvert, any concrete lining may also help prevent contamination migration to surface water.

The risk to controlled water receptors is considered moderate. Due to the presence of heavy metals and organic hydrocarbon compounds in the perched groundwater, careful consideration of risks to site operatives and the potential requirement for water pretreatment will be necessary.

Given the presence of the underlying principal bedrock aquifer with the potential for vertical migration of perched water through the historical infilled Made Ground towards this receptor, a DQRA is recommended to determine practicable and deliverable remediation targets for the soils (considered a secondary source).

3. DETAILED CONTROLLED WATERS RISK ASSESSMENT

Concentrations of heavy metals and aromatic hydrocarbon compounds have been recorded in soil, leachate and groundwater samples, which are considered to pose a potential long-term risk to the identified primary receptor (Principal Aquifer) associated with the leaching and mobilisation of potentially soluble compounds, which could eventually generate a complete pollutant linkage. The sensitivity of the principal aquifer is reduced, given there are no potable groundwater abstractions within 1km.

The culvert is likely to be present at a shallow depth, therefore is unlikely to be in hydraulic connectivity. Depending on the construction of the culvert, any concrete lining may also help prevent contamination migration to surface water.

Elevated concentrations of heavy metals and aromatic hydrocarbon compounds pose a risk to the underlying principal aquifer and surface water features. Site Specific Remediation Targets (SSRTs) will be calculated for the protection of controlled waters, and therefore, the site can be delivered and remediated in a manner that would ensure the land poses no significant risk to controlled waters or the wider environ.

In light of the potential for the creation of a complete pollutant linkage, E3P has developed SSRTs to facilitate a further informed understanding to which the site poses a serious risk to controlled waters and the wider environ.

This Tier 3 Quantitative Risk Assessment has been completed to provide a series of site derived validation criteria which may be utilised to validate soils which have undergone remediation.

The Tier 2 controlled waters risk assessment alongside the human health risk assessment, has determined the following compounds could present a theoretical risk to the identified receptors:

CONTAMINANT EXCEEDANCE
Arsenic
Chromium VI
Chromium III
Copper
Cyanide
Lead
Nickel
Manganese
Zinc
Naphthalene
TPH C5-C7 Aromatic
TPH C8-10 Aromatic
TPH C10-12 Aromatic
TPH C12-C16 Aromatic
Benzene
Xylene
Trichloromethane
Phenol

The DQRA has been undertaken using the soil and groundwater data obtained over the various phases of works in order to calculate Site Specific Remedial Targets (SSRTs) for the shallow soils, to model the theoretical migration of the identified contaminants through the drift deposits to the most sensitive primary receptor, the Principal Aquifer.

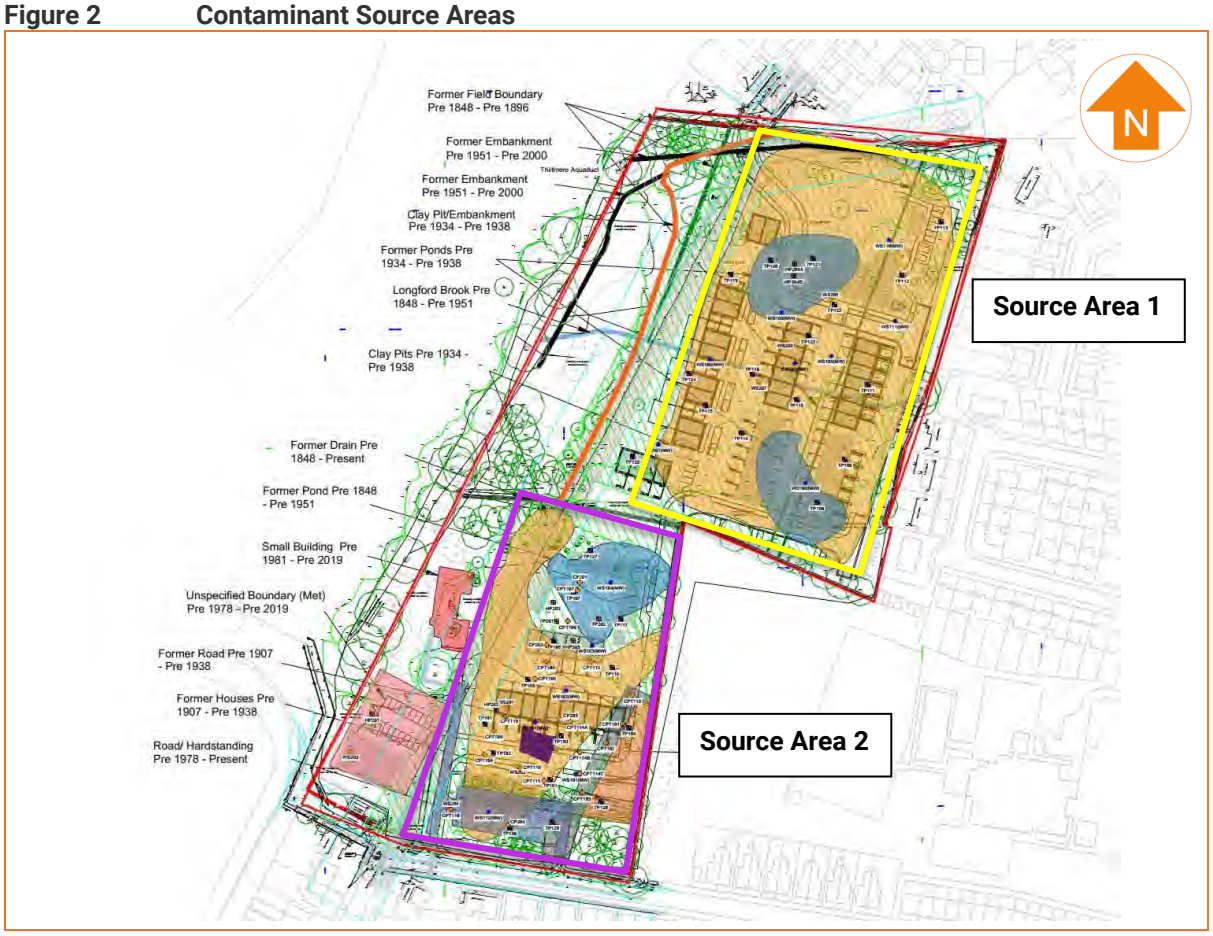
Two separate contaminant sources have been identified as follows:

- Source Area 1 – Infilled clay pit (northern sector)
- Source Area 2 – Infilled clay pit (southern sector)

The Made Ground associated with the infilled clay pits is considered to be a potential source of leachable metals and aromatic hydrocarbon compounds, given the widespread exceedances identified in soils and groundwater samples. A primary source has not been identified. The hydrocarbon compounds are considered to be associated with the combustion of coal.

Figure 2 identifies the two source areas which will be modelled. Source Area 1 is denoted by the yellow boundary, and Source Area 2 is denoted by the purple boundary.

Figure 2 Contaminant Source Areas



3.1. DISCUSSION OF PHYSICAL PARAMETERS

The Glacial Till is considered to inhibit migration to the controlled water receptors, however, the Made Ground is granular and is where the impact has been recorded as such, the RTM model is based on these soils.

The water strikes encountered are confirmed as a perched pocket within the Made Ground. It is common for fully permeable anthropogenic materials such as this to contain perched water, which, when released during excavation, can result in rapid water ingress into a trial pit.

Groundwater is considered to flow to the north based on the groundwater modelling data. E3P have produced a Groundwater Flow Plan (Drawing 17-403-028) appended to this report.

The underlying sandstone bedrock (Principal Aquifer) was not encountered during the ground investigation, however boreholes were completed to a maximum depth of 17.83 m bgl. A conservative depth of 20.00 m bgl has been used as the depth to the top of bedrock. The compliance point of **20.00 m** from the contaminant source area to the underlying bedrock is considered to be conservative and will be utilised within the assessment.

The hydraulic gradient for the northern sector of the site has been calculated using levelling data to be **0.00033.** The hydraulic gradient for the southern sector has been calculated to be **0.00165.**

Soil analysis data for total organic carbon (TOC) has been obtained by E3P, these have been used to calculate a Fraction Organic Carbon (FOC) value of **0.0609.**

Additionally, E3P has reviewed the annual rainfall data on the Met office for the area and taking into account evapotranspiration and the proposed development containing a large volume of hardstanding and residential buildings, a 1% infiltration figure has been calculated as **0.0000147**.

Further details regarding the various physical and chemical inputs required for the DQRA are included within Table 4 and 5.

Table 4 DQRA Physical Input Parameters

PARAMETER	VALUE	SOURCE	JUSTIFICATION
Method of calculating partition co-efficient	Non-polar Organic Chemicals		
Analytical Solution	Ogata Banks		
Degradation Conditions (aerobic / anaerobic)	Assumed anaerobic conditions to remain conservative		
Level Three - Groundwater			
Pathway Aquifer	N/A	N/A	Migration is assumed to be via sand and gravel lenses to the principal aquifer
Saturated aquifer thickness (m)	18.00	Estimate from borehole data	Approximation based on ground conditions encountered on site within boreholes and likely depth to top of bedrock.
Bulk density of soil (g/cm3)	1.18	SR3	Taken from the value for sand within the Updated Technical Background CLEA-SR3 (Source of Contaminants: Made Ground Gravel)
Air filled porosity (cm3/cm3)	0.30	SR3	Taken from the value for sand within the Updated Technical Background CLEA-SR3 (Source of Contaminants: Made Ground Gravel)
Water filled porosity (cm3/cm3)	0.24	SR3	Taken from the value for sand within the Updated Technical Background CLEA-SR3 (Source of Contaminants: Made Ground Gravel)
Effective porosity of the aquifer (cm3/cm3)	0.54	SR3	Taken from the value for sand within the Updated Technical Background CLEA-SR3 (Source of Contaminants: Made Ground Gravel)
Hydraulic gradient	0.00033 (SA1) 0.00165 (SA2)	Site Data	Calculated using site levelling data
Hydraulic conductivity of the aquifer (m/d)	6.36	SR3	Taken from the value for sand within the Updated Technical Background CLEA-SR3
Distance to compliance point (m)	20	Site Compliance Point	The compliance point is believed to be the distance to the underlying principal aquifer from the source area
Assumed groundwater flow direction	North	Site Data	Based on site data and groundwater modelling.
Fraction Organic Carbon in aquifer (FOC)	0.0609	Site Data	Based on site soil samples.
Source Area 1 – Infilled Clay Pit (Northern Sector)			
Width of plume in aquifer at source (m)	90	Site Data	Based on site data and observations.
Length of plume in aquifer at source (m)	180	Site Data	Based on site data and observations.
Source Area 2 – Infilled Clay Pit (Southern Sector)			
Width of plume in aquifer at source (m)	70	Site Data	Based on site data and observations.

PARAMETER	VALUE	SOURCE	JUSTIFICATION
Length of plume in aquifer at source (m)	140	Site Data	Based on site data and observations.
Source Area 1 – (10 x 10 m) – Northern Sector			
Width of plume in aquifer at source (m)	10	Site Data	Based on site data and observations.
Length of plume in aquifer at source (m)	10	Site Data	Based on site data and observations.
Source Area 2 – (10 x 10 m) – Southern Sector			
Width of plume in aquifer at source (m)	10	Site Data	Based on site data and observations.
Length of plume in aquifer at source (m)	10	Site Data	Based on site data and observations.
Source Area 1 – Infilled Clay Pit (Northern Sector)			
Plume thickness at source (m)	18.0	Calculated within RTM	This value is calculated from the mixing thickness within the Level 2 soils in the RTM model.
Source Area 1 – (10 x 10 m) – Northern Sector			
Plume thickness at source (m)	15.0	Specified	This value is specified within the Level 2 soils in the RTM model.
Source Area 2 – Infilled Clay Pit (Southern Sector)			
Plume thickness at source (m)	15.0	Calculated within RTM	This value is calculated from the mixing thickness within the Level 2 soils in the RTM model.
Source Area 2 – (10 x 10 m) – Southern Sector			
Plume thickness at source (m)	15.0	Specified	This value is specified within the Level 2 soils in the RTM model.

Table 5 General DQRA Chemical Input Parameters – Source Area 1

CONTAMINANT	KOC (l/kg)	KD	SOURCE	ANAEROBIC DEG. HALF-LIFE (D)	AEROBIC DEG. HALF-LIFE (D)	SOURCE	HENRY 'S LAW	SOURCE
Arsenic	-	500	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Copper	-	100	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Cyanide	-	100	Estimate	9.99E+99	9.99E+99	EA	0	EA
Lead	-	500	Estimate	9.99E+99	9.99E+99	EA	0	EA
Nickel	-	500	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Zinc	-	38	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Naphthalene	645.65	-	LQM-CIEH	258	20	Howard et al Naphthalene	0.00662	LQM-CIEH
TPH Aromatic C5-C7	67.61	-	LQM-CIEH	730	16	Howard et al Benzene	0.116	LQM-CIEH
TPH Aromatic C8-C10	1584.89	-	LQM-CIEH	228	10	Howard et al-Ethylbenzene	0.253	LQM-CIEH
TPH Aromatic C10-C12	2511.89	-	LQM-CIEH	258	258	Howard et Naphthalene	0.0722	LQM-CIEH
Phenol	28.84	-	LQM-CIEH	28	3.5	Howard et Phenol	8.35 E-06	LQM-CIEH

Table 6 General DQRA Chemical Input Parameters – Source Area 2

CONTAMINANT	KOC (l/kg)	KD	SOURCE	ANAEROBIC DEG. HALF-LIFE (D)	AEROBIC DEG. HALF-LIFE (D)	SOURCE	HENRY'S LAW	SOURCE
Arsenic	-	500	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Copper	-	100	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Chromium (III)	-	4800	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Chromium (VI)	-	18	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Cyanide	-	100	Estimate	9.99E+99	9.99E+99	EA	0	EA
Lead	-	500	Estimate	9.99E+99	9.99E+99	EA	0	EA
Manganese		500	Estimate	9.99E+99	9.99E+99	EA	0	EA
Nickel	-	500	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Zinc	-	38	LQM-CIEH	9.99E+99	9.99E+99	EA	0	EA
Naphthalene	645.65	-	LQM-CIEH	258	20	Howard et al Naphthalene	0.00662	LQM-CIEH
TPH Aromatic C5-C7	67.61	-	LQM-CIEH	730	16	Howard et al Benzene	0.116	LQM-CIEH
TPH Aromatic C8-C10	1584.89	-	LQM-CIEH	228	10	Howard et al-Ethylbenzene	0.253	LQM-CIEH
TPH Aromatic C10-C12	2511.89	-	LQM-CIEH	258	258	Howard et al Naphthalene	0.0722	LQM-CIEH
TPH Aromatic C12-C16	5011.87	-	LQM-CIEH	1840	920	Conservative Estimate	0.00126	LQM-CIEH
Trichloromethane	50.12	-	LQM-CIEH	28	180	Howard et al Chloroform	0.0765	LQM-CIEH
Benzene	67.61	-	LQM-CIEH	730	16	Howard et al Benzene	0.116	LQM-CIEH
p-xylene	446.68	-	LQM-CIEH	112	28	Howard et al p-xylene	0.107	LQM-CIEH
m-xylene	489.78	-	LQM-CIEH	112	28	Howard et al m-xylene	0.112	LQM-CIEH
o-xylene	426.58	-	LQM-CIEH	365	28	Howard et al o-xylene	0.092	LQM-CIEH

With respect to the inorganic and organic contamination in **Source Area 1,** soil and groundwater concentrations have been selected from the maximum soil concentrations and laboratory results from the infilled clay pit in the northern sector, with the maximum concentrations taken for each contaminant of concern. The source area has been taken as the mapped area (90 m x 180 m). The source area is considered to be widespread. It is important that with a remediation of this nature, a balance is achieved between successful validation and viability, to ensure the site may be remediated successfully, validated and delivered for residential development with the full protection of human health, controlled waters and the wider environs. With this in mind, with regards the contamination known to be present across the northern sector, two sets of remedial target values are to be calculated:

- Entire site area (90 m x 180 m) – this will enable a set of values to be calculated that will be directly attributable to the entire area as a whole, with values on a lower margin however in the vast majority of soils, will be largely achievable.

- A modelled 10 m x 10 m square – for those soils which may be more contaminated and which may not be able to be remediated to meet the remedial targets generated from the entire site area, to enable the successful remediation and validation in a cost-effective manner but still ensuring the protection of controlled waters (and human health/wider environ), these set of remedial targets may be utilised.

With respect to the inorganic and organic contamination in **Source Area 2,** soil and groundwater concentrations have been selected from the maximum soil concentrations and laboratory results from the infilled clay pit in the southern sector, with the maximum concentrations taken for each contaminant of concern. The source area has been taken as the mapped area (70 m x 140 m). The source area is considered to be widespread. It is important that with a remediation of this nature, a balance is achieved between successful validation and viability, to ensure the site may be remediated successfully, validated and delivered for residential development with the full protection to human health, controlled waters and the wider environs. With this in mind, with regards the contamination known to be present across the northern sector, two sets of remedial target values are to be calculated:

- Entire site area (70 m x 140 m) – this will enable a set of values to be calculated that will be directly attributable to the entire area as a whole, with values on a lower margin however in the vast majority of soils, will be largely achievable.

- A modelled 10 m x 10 m square – for those soils which may be more contaminated and which may not be able to be remediated to meet the remedial targets generated from the entire site area, to enable the successful remediation and validation in a cost effective manner but still ensuring the protection of controlled waters (and human health/wider environ), these set of remedial targets may be utilised.

Table 7 Maximum Site Concentrations in Soil

CONTAMINANT	MAX CONC IN SOIL (mg/kg)	SITE SOURCE
Source Area 1 – Infilled Clay Pit (Northern Sector)		
Arsenic	32	TP120
Copper	620	TP119
Cyanide	120	TP119
Lead	1000	TP119
Nickel	33	TP120
Zinc	1000	TP119
Naphthalene	0.72	WS205
TPH Aromatic C5-C7	<1.0	-
TPH Aromatic C8-C10	29	WS207
TPH Aromatic C10-C12	20	WS207
Phenol	<0.50	-
Source Area 2 – Infilled Clay Pit (Southern Sector)		
Arsenic	150	WS202
Copper	2600	TP128
Chromium (III)	46	WS204
Chromium (VI)	<0.50	-
Cyanide	73	WS202
Lead	1100	WS102
Manganese	-	-
Nickel	110	WS204
Zinc	2500	WS112
Naphthalene	19	CP203
TPH Aromatic C5-C7	2.3	WS203
TPH Aromatic C8-C10	53	WS201
TPH Aromatic C10-C12	40	TP103
TPH Aromatic C12-C16	200	TP116

CONTAMINANT	MAX CONC IN SOIL (mg/kg)	SITE SOURCE
Trichloromethane	<0.001	-
Benzene	0.05	CP203
p-xylene	1.7	CP203
m-xylene	1.7	CP203
o-xylene	0.97	CP203

Table 8 Maximum Site Concentrations in Leachate/Groundwater

CONTAMINANT	MAX CONC IN LEACHATE/GW (µg/l)	MAX CONC IN LEACHATE/GW (mg/l)	SITE SOURCE
Source Area 1 – Infilled Clay Pit (Northern Sector)			
Arsenic	28	0.028	WS205
Copper	9.1	0.0091	WS110
Cyanide	81	0.081	CP102
Lead	16	0.016	WS110
Nickel	22	0.022	WS110
Zinc	48	0.048	WS110
Naphthalene	3.4	0.0034	CP102
TPH Aromatic C5-C7	7.0	0.007	CP102
TPH Aromatic C8-C10	12	0.012	CP102
TPH Aromatic C10-C12	48	0.048	CP102
Phenol	17	0.017	CP102
Source Area 2 – Infilled Clay Pit (Southern Sector)			
Arsenic	18	0.018	WS202
Copper	7.5	0.0075	CP101
Chromium (III)	5.7	0.0057	CP101
Chromium (VI)	20	0.020	TP106
Cyanide	160	0.16	CP101
Lead	26	0.026	WS106
Manganese	880	0.88	CP204
Nickel	19	0.019	WS202
Zinc	530	0.53	CP201/CP204
Naphthalene	270	0.27	CP204
TPH Aromatic C5-C7	11	0.011	CP101
TPH Aromatic C8-C10	390	0.39	CP202
TPH Aromatic C10-C12	430	0.43	WS201
TPH Aromatic C12-C16	220	0.22	CP101
Trichloromethane	9.1	0.0091	CP101
Benzene	130	0.13	CP201
p-xylene	100	0.10	CP203
m-xylene	100	0.10	CP203
o-xylene	78	0.078	CP203

3.2. RESULTS

The results of the risk assessment are summarised in Table 9.

The results provide remediation target concentrations for the soils, which may be used for validation purposes following the remediation of the impacted Made Ground.

Table 9 Results

CONTAMINANT	SOURCE CONCENTRATION USED IN RTM MODEL		LEVEL 3 REMEDIAL TARGET CONCENTRATION		
	SOILS (mg/kg)	GROUNDWATER (mg/l)	SOILS (mg/kg)	LEACHATE (mg/l)	LEACHATE (ug/l)
Source Area 1 – Infilled Clay Pit (Northern Sector)					
Arsenic	32	0.028	75.7	0.151	151
Copper	620	0.0091	3060	30.6	30600
Cyanide	**120**	0.081	76.4	0.762	762
Lead	**1000**	0.016	75.7	0.151	151
Nickel	33	0.022	152	0.304	304
Zinc	**1000**	0.048	6.31	0.165	165
Naphthalene	0.72	0.0034	9930	251	251000
TPH Aromatic C5-C7	<1.0	0.007	19.8	4.55	4550
TPH Aromatic C8-C10	29	0.012	1.44 E+04	1.49 E+04	1.49 E+07
TPH Aromatic C10-C12	20	0.048	3.5 E+05	2290	2290000
Phenol	<0.50	0.017	2.09 E+12	1.07E+12	1.07E+15
Source Area 1 – (10 m x 10 m grid)					
Arsenic	32	0.028	1150	2.31	2310
Copper	620	0.0091	46700	466	466000
Cyanide	120	0.081	1170	11.6	11600
Lead	1000	0.016	1150	2.31	2310
Nickel	33	0.022	2320	4.64	4640
Zinc	**1000**	0.048	96.2	2.52	2520
Naphthalene	0.72	0.0034	2.12 E+05	5370	5.37E+06
TPH Aromatic C5-C7	<1.0	0.007	361	82.9	82900
TPH Aromatic C8-C10	29	0.012	1.04 E+06	1.07 E+04	1.07 E+07
TPH Aromatic C10-C12	20	0.048	7.47 E+06	4.87E+04	4.87E+07
Phenol	<0.50	0.017	9.66 E+13	4.93E+13	4.93E+16
Source Area 2 – Infilled Clay Pit (Southern Sector)					
Arsenic	150	0.018	384	0.768	768
Copper	2600	0.0075	15500	155	155000
Chromium (III)	46	0.0057	18600	3.87	3870
Chromium (VI)	<0.50	0.020	4.66	0.256	256
Cyanide	73	0.16	388	3.87	3870
Lead	**1100**	0.026	384	0.768	768
Manganese	-	0.88	1940	3.87	3870
Nickel	110	0.019	772	1.54	1540
Zinc	**2500**	0.53	32	0.838	838
Naphthalene	19	0.27	283	7.15	7150
TPH Aromatic C5-C7	2.3	0.011	8.10	1.86	1860
TPH Aromatic C8-C10	53	0.39	26800	276	276000
TPH Aromatic C10-C12	40	0.43	9950	64.9	64900
TPH Aromatic C12-C16	200	0.22	3080	10.1	10100

CONTAMINANT	SOURCE CONCENTRATION USED IN RTM MODEL		LEVEL 3 REMEDIAL TARGET CONCENTRATION		
	SOILS (mg/kg)	GROUNDWATER (mg/l)	SOILS (mg/kg)	LEACHATE (mg/l)	LEACHATE (ug/l)
Trichloromethane	<0.001	0.0091	68100	2.08 E+04	2.08 E+07
Benzene	0.05	0.13	8.10	1.86	1860
p-xylene	1.7	0.10	8.44 E+04	3080	3.08E+06
m-xylene	1.7	0.10	9.25 E+04	3080	3.08E+06
o-xylene	0.97	0.078	5320	203	203000
Source Area 2 – (10 m x 10 m grid)					
Arsenic	150	0.018	5750	11.5	11500
Copper	2600	0.0075	2.33 E+05	2320	2.32E+06
Chromium (III)	46	0.0057	2.78 E+05	58	58000
Chromium (VI)	<0.50	0.020	69.8	3.83	3830
Cyanide	73	0.16	5810	58	58000
Lead	1100	0.026	5750	11.5	11500
Manganese	-	0.88	29000	58	58000
Nickel	110	0.019	11600	23.1	23100
Zinc	**2500**	0.53	479	12.5	12500
Naphthalene	19	0.27	4330	110	110000
TPH Aromatic C5-C7	2.3	0.011	123	28.2	28200
TPH Aromatic C8-C10	53	0.39	4.11E+05	4250	4.25E+06
TPH Aromatic C10-C12	40	0.43	1.52 E+05	995	995000
TPH Aromatic C12-C16	200	0.22	4.63 E+04	152	152000
Trichloromethane	<0.001	0.0091	1.12 E+06	3.43 E+05	3.43 E+08
Benzene	0.05	0.13	11.4	2.62	2620
p-xylene	1.7	0.10	1.32 E+06	4.80 E+04	4.80 E +07
m-xylene	1.7	0.10	1.44 E+06	4.80 E+04	4.80 E +07
o-xylene	0.97	0.078	8.10 E+04	3.09 E+03	3.09 E+06

Site Specific Remedial Targets (SSRTs) have been produced from the P20 RTM.

Where the existing contaminant concentration, identified during the various phases of intrusive investigation, exceeds the remedial target value, the value has been highlighted in orange where the exceedances appear to be present.

3.3. CONCLUSIONS

Source Area 1 – Infilled Clay Pit (Northern Sector)

The results of the modelling have generated two sets of site specific screening values; one utilising a modelled 10 x 10m grid and a second set using the actual measured area of the site area, in order to ensure a suitable and deliverable remediation and validation programme.

The results of the P20 modelled for the source area indicate that elevated concentrations of cyanide, lead and zinc have been recorded in soil samples when compared to the Level 3 remediation targets. When modelled on a 10 x 10m grid, only zinc exceeds the Level 3 concentration.

Varying the time since the pollutant entered the groundwater suggests that zinc would not reach the receptor until circa 52,000 years based on calculations within the model (10 x 10 m grid). Therefore, this shows that there is no significant risk to the controlled waters receptors from the existing soil concentrations and remediation works are not considered to be required.

The concentrations in groundwater/leachate samples do not exceed SSRTs, therefore remediation works are not considered to be required.

Source Area 2 – Infilled Clay Pit (Southern Sector)

The results of the modelling have generated two sets of site specific screening values; one utilising a modelled 10 x 10m grid and a second set using the actual measured area of the site area, in order to ensure a suitable and deliverable remediation and validation programme.

The results of the P20 modelled for the source area indicates that elevated concentrations of lead and zinc have been recorded in soil samples when compared to the Level 3 remediation targets. When modelled on a 10 x 10m grid, only zinc exceeds the Level 3 concentration.

Varying the time since the pollutant entered the groundwater suggests that zinc would not reach the receptor until circa 10,500 years based on calculations within the model (10 x 10 m grid). Therefore, this shows that there is no significant risk to the controlled waters receptors from the existing soil concentrations and remediation works are not considered to be required.

The application of the Level 3 RTM values has been integral to determining the potential risks posed by contaminants in soil and groundwater. The modelling specifically assessed the potential for contaminant migration and the subsequent risks to controlled waters. The results from Source Area 1 (northern sector) and Source Area 2 (southern sector) consistently show that, while elevated concentrations of metals such as zinc, lead, and cyanide were recorded in the soils, these compounds exhibit limited mobility due to their largely insoluble nature.

For example, zinc, when modelled under the 10 x 10 m grid scenario, was found to exceed the Level 3 RTM values in the soil. However, the calculated time for this contaminant to reach the Principal Aquifer — a critical receptor — is approximately 52,000 years. This extensive timescale clearly indicates that the migration of zinc through the groundwater is not a significant concern, as it would take an exceedingly long period for the contaminant to reach the aquifer at concentrations that could cause harm.

Similarly, for Source Area 2, elevated concentrations of lead and zinc were detected in the soils. When the model was applied to a 10 x 10 m grid, zinc exceeded the Level 3 RTM values, but the modelling suggests that the time for zinc to reach the receptor is approximately 10,500 years. This similarly long timeframe further reinforces that there is minimal risk of significant contamination migration, particularly in comparison to the typical lifespan of development projects.

The very slow travel times of these largely insoluble contaminants, coupled with the presence of low-permeability layers within the site that inhibit downward migration, significantly reduce the overall risk of contamination reaching controlled waters. The calculated migration times demonstrate that these compounds will not reach critical receptors within any relevant operational or environmental timeframe.

Therefore, based on these modelling results, the risk from these contaminants is deemed negligible, and the proposed remediation measures — such as further monitoring and potential localised remediation are more than sufficient to mitigate any long-term risks associated with the identified contaminants. These findings validate the decision that no major remediation efforts are necessary for the impacted areas of the site. The Level 3 RTM values, alongside the modelling of travel times, provide clear assurance that the site can be safely developed without posing a significant risk to the controlled waters or the broader environment.

The report's assessment highlights that the current unsurfaced state of the site allows unrestricted rainfall infiltration, which increases the risk of contaminant mobilisation and leaching into the groundwater. The proposed development, with 60% of the site made impermeable, will significantly reduce infiltration by 2,185 m³ per year per acre. This will lower the hydraulic connectivity between surface water and groundwater, thus mitigating the mobilisation of contaminants, such as PAHs and TPHs, present in the Made Ground.

By reducing infiltration, this strategy represents the most sustainable remediation solution. It addresses the risk of contamination migration at its source, providing a long-term, cost-effective measure. The contaminants will be confined closer to the surface, allowing for effective surface-level remediation and reducing the need for costly groundwater treatment, ensuring both environmental compliance and sustainable development.

In the context of the developed site Conceptual Site Model (CSM), the reduction in infiltration ensures that there is no significant risk to a viable receptor. The contaminants present within the Made Ground will remain confined to the surface, with limited potential for migration to the underlying aquifers or surface water features. This confirms that, following the proposed development and mitigation measures, the site poses no risk to controlled waters or any other viable receptors.

I trust this information is satisfactory to your requirements, and should I be able to be of any further assistance, please do not hesitate to contact me.

Yours sincerely,

For and on behalf of E3P Ltd

Written by:
Nicola Sellars
Senior Geoenvironmental Consultant

Reviewed by:
Stephanie Cox
Director

Approved by:
Martin Dyer
Director

Drawing List
17-403-001 - Site Location Plan
17-403-002 - Proposed Development Plan
17-403-003 - Historical Features Plan
17-403-004 - Site Features Plan
17-403-005 - Exploratory Hole Location Plan (Site Constraints)

17-403-007 - Depth of Made Ground Plan
17-403-010 - Conceptual Site Model
17-403-014 - Contamination Exceedances Plan – Human Health
17-403-024 - Combined Plan (Historical Features, EHLP and Proposed Development)
17-403-026 - Exploratory Hole Location Plan (Redacted)
17-403-027 - Contamination Exceedances Plan – Controlled Waters
17-403-028 - Groundwater Flow Plan

APPENDIX I
DRAWINGS



DRAWING 17-403-001 – SITE LOCATION PLAN





Historical Features

- Small Building Pre 1981 - Pre 2019
- Former Pond Pre 1848 - Pre 1951 / Pre 1934 - Pre 1938
- Former Houses Pre 1907 - Pre 1938
- Former Road Pre 1907 - Pre 1938
- Unspecified Building Pre - 1848 - Pre 1894
- Unspecified Boundary (Met) Pre 1978 - Pre 2019
- Former Clay Pits Pre 1934 - Pre 1938
- Road/Hardstanding Pre 1978 - Present
- Longford Brook Pre 1848 - Pre 1951
- Former Field Boundary Pre 1848 - Pre 1896
- Former Drain Pre 1848 - Present
- Former Embankment Pre 1951 - Pre 2000
- Former Clay pit/embankment Pre 1934 - Pre 1938
- BGS Recorded Mineral Site (Former Clay Pit)

Notes:

Client:
First Step Group Ltd

Job No: 17-403

Date: 30.10.2024

Drawing No: 003

Scale: NTS@ A3

Phase	Issue	Date	Drawn	Checked	PM
P1	REVB	30.10.2024	OW	ND	ND
P1	REVA	10.10.2024	OW	ND	BH

Job Title:
Ryebank Fields

Drawing Title:
Historical Features Plan

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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P1	REVA	25.09.2024	OW	ND	BH	
Phase	Issue	Date	Drawn	Checked	PM	

Notes:

Client:
First Step Group Ltd

Job No: 17-403

Date: 25.09.2024

Drawing No: 002

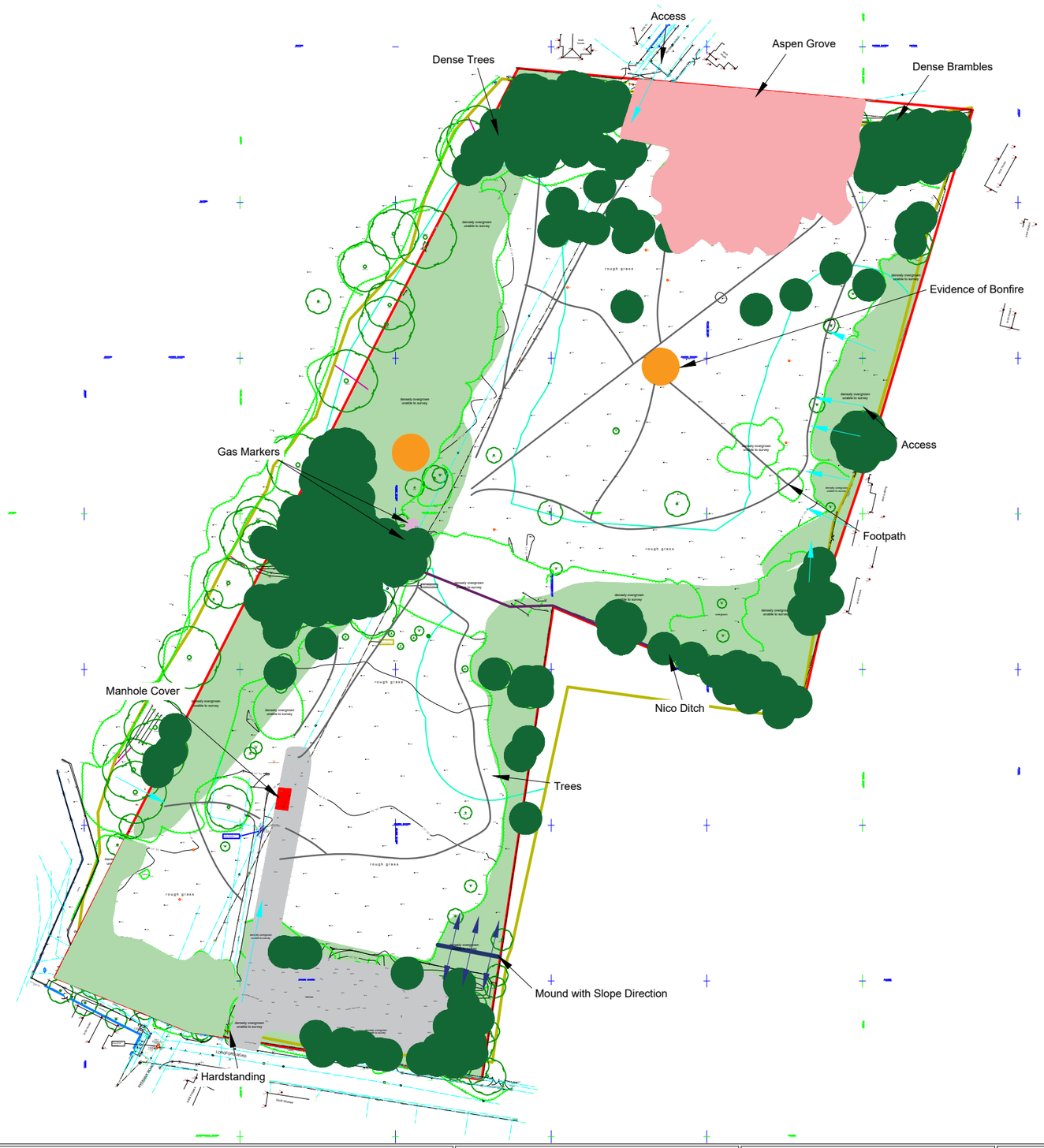
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Job Title:
Ryebank Fields

Drawing Title:
Proposed Development Plan

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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Site Features

- Trees
- Dense Brambles
- Footpath
- Evidence of Bonfire
- Access
- Dense Trees
- Nico Ditch
- Mound with Slope Direction
- Manhole Cover
- Gas Markers
- Hard Standing
- Aspen Grove

Notes:

Client: First Step Group Ltd

Job No: 17-403

Date: 29.07.2024

Drawing No: 004

Scale: NTS@ A3

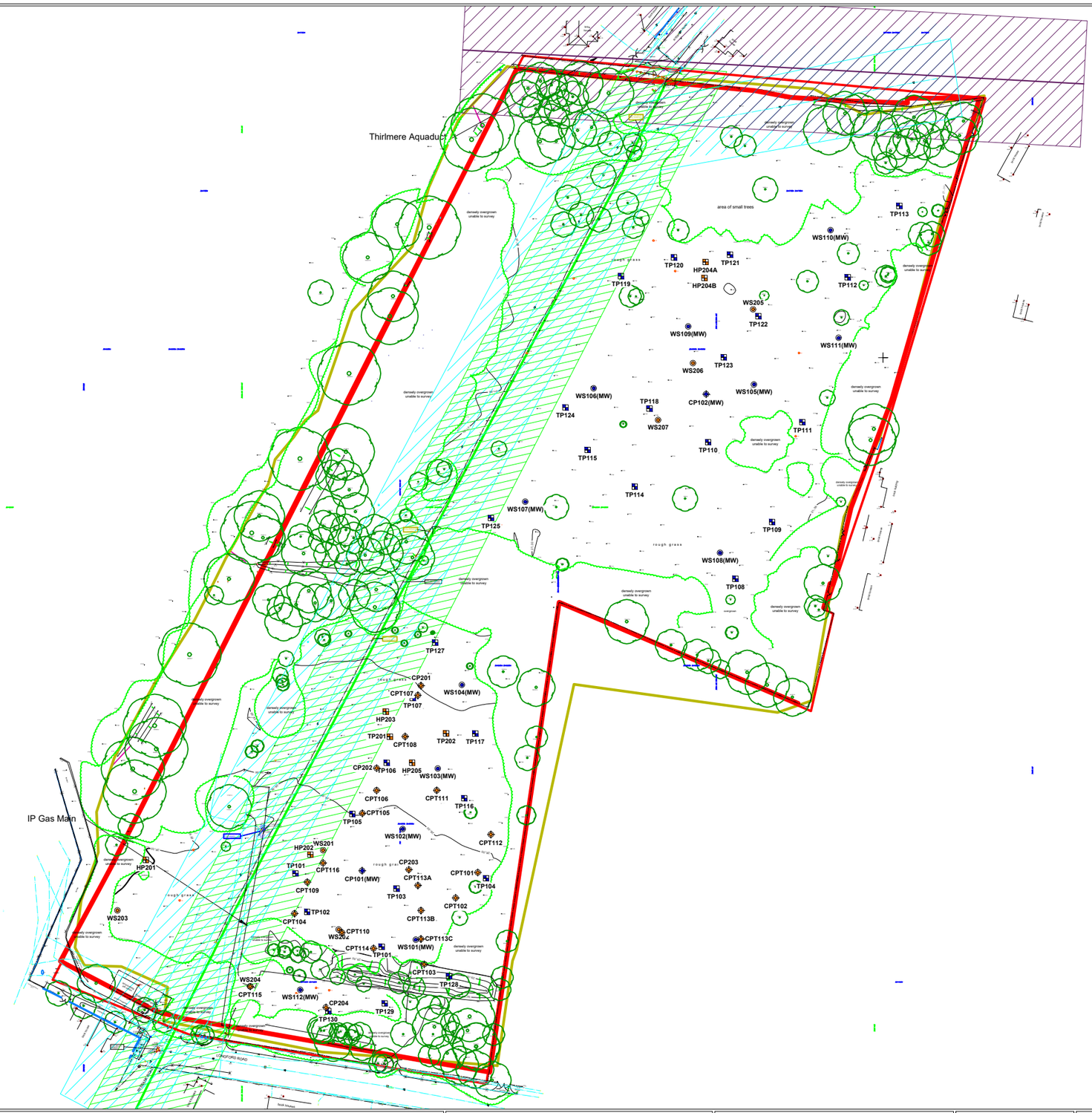
Phase	Issue	Date	Drawn	Checked	PM
P1	REVB	29.07.2024	OW	GC	BH
P1	REVA	05.07.2024	OW	ND	BH

Job Title: Ryebank Fields

Drawing Title: Site Features Plan

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E-mail: info@e3p.co.uk
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Location Symbols

- Approximate Window Sample Probehole Location (E3P Locations 2024)
- Approximate Trial Pit Location (E3P Locations 2024)
- Approximate Cable Percussive Borehole Location (E3P Locations 2024)
- Approximate Cone Penetrometer Test Location (E3P Locations 2024)
- Approximate Window Sample Probehole Location (E3P Locations 2019)
- Approximate Window Sample Probehole Location with Install (E3P Locations 2019)
- Approximate Trial Pit Location (E3P Locations 2019)
- Approximate Cable Percussive Borehole Location (E3P Locations 2019)

- IP Gas Pipe with 15m Easement
- Thirlmere Aquaduct with 20m Easement
- Sewer Easement with 15m Easement

Notes:

Easement are Based on Requirements for Site Investigation not Proposed Development

Phase	Issue	Date	Drawn	Checked	PM
P1	REVC	08.11.2024	OW	ND	ND
P1	REVB	19.09.2024	OW	ND	ND
P1	REVA	02.08.2024	CB	ND	BH

Client: First Step Group Ltd

Job No: 17-403

Date: 08.11.2024

Drawing No: 026

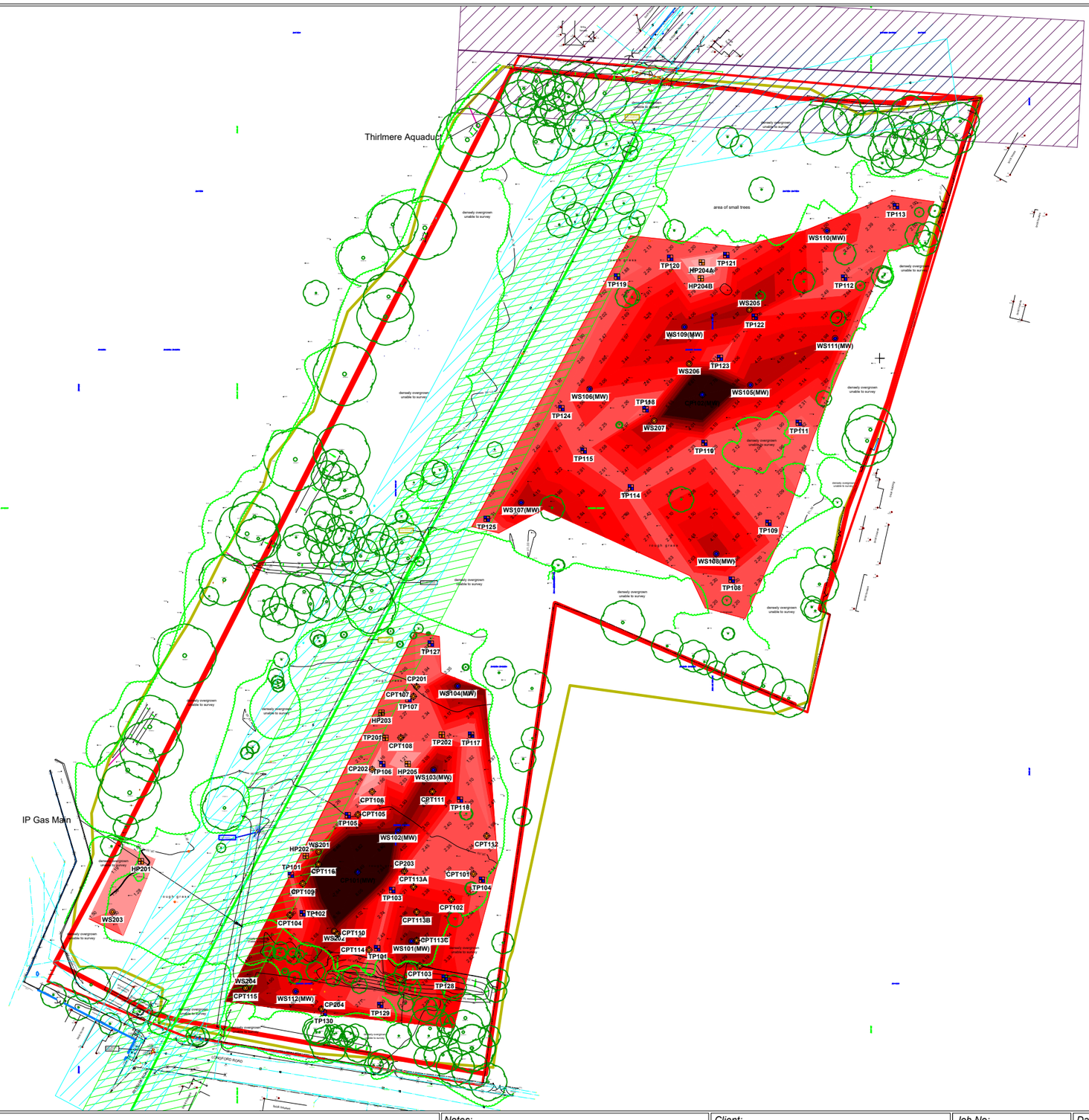
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Job Title: Ryebank Fields

Drawing Title: Exploratory Hole Location Plan (Site Constraints - Redacted)

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
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Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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Location Symbols

- Approximate Window Sample Probehole Location (E3P Locations 2024)
- Approximate Trial Pit Location (E3P Locations 2024)
- Approximate Cable Percussive Borehole Location (E3P Locations 2024)
- Approximate Cone Penetrometer Test Location (E3P Locations 2024)
- Approximate Window Sample Probehole Location (E3P Locations 2019)
- Approximate Window Sample Probehole Location with Install (E3P Locations 2019)
- Approximate Trial Pit Location (E3P Locations 2019)
- Approximate Cable Percussive Borehole Location (E3P Locations 2019)

- IP Gas Pipe with 15m Easement
- Thirlmere Aquaduct with 20m Easement
- Sewer Easement with 15m Easement

Made Ground Depth (m)

- Depth of Made Ground 1.00 - 1.49m
- Depth of Made Ground 1.50 - 1.99m
- Depth of Made Ground 2.00 - 2.49m
- Depth of Made Ground 2.50 - 2.99m
- Depth of Made Ground 3.00 - 3.49m
- Depth of Made Ground 3.50 - 3.99m
- Depth of Made Ground 4.00 - 4.49m
- Depth of Made Ground 4.50 - 4.99m
- Depth of Made Ground <5.00m

Notes:

Client: First Step Group Ltd

Job No: 17-403

Date: 08.11.2024

Drawing No: 007

Scale: NTS@ A3

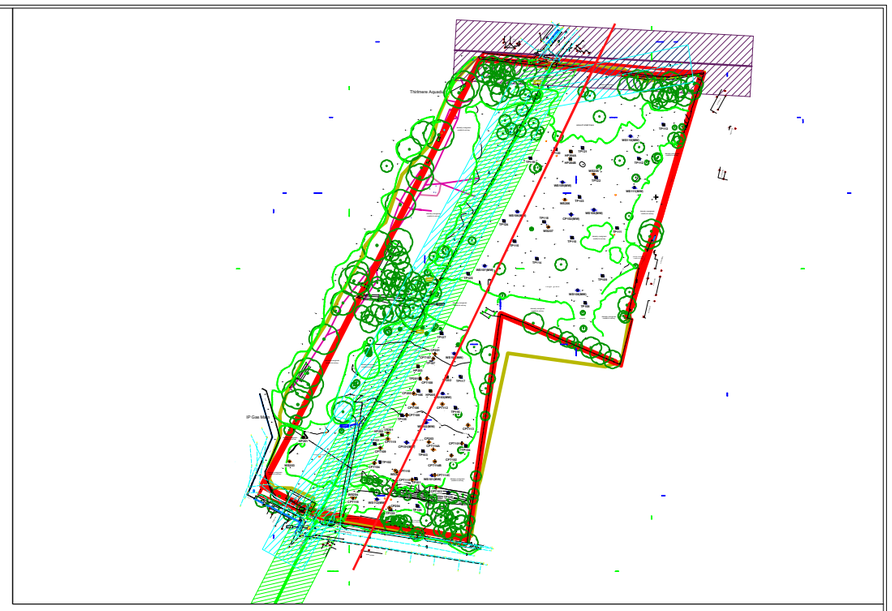
Phase	Issue	Date	Drawn	Checked	PM
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P1	REVA	10.10.2024	OW	ND	ND

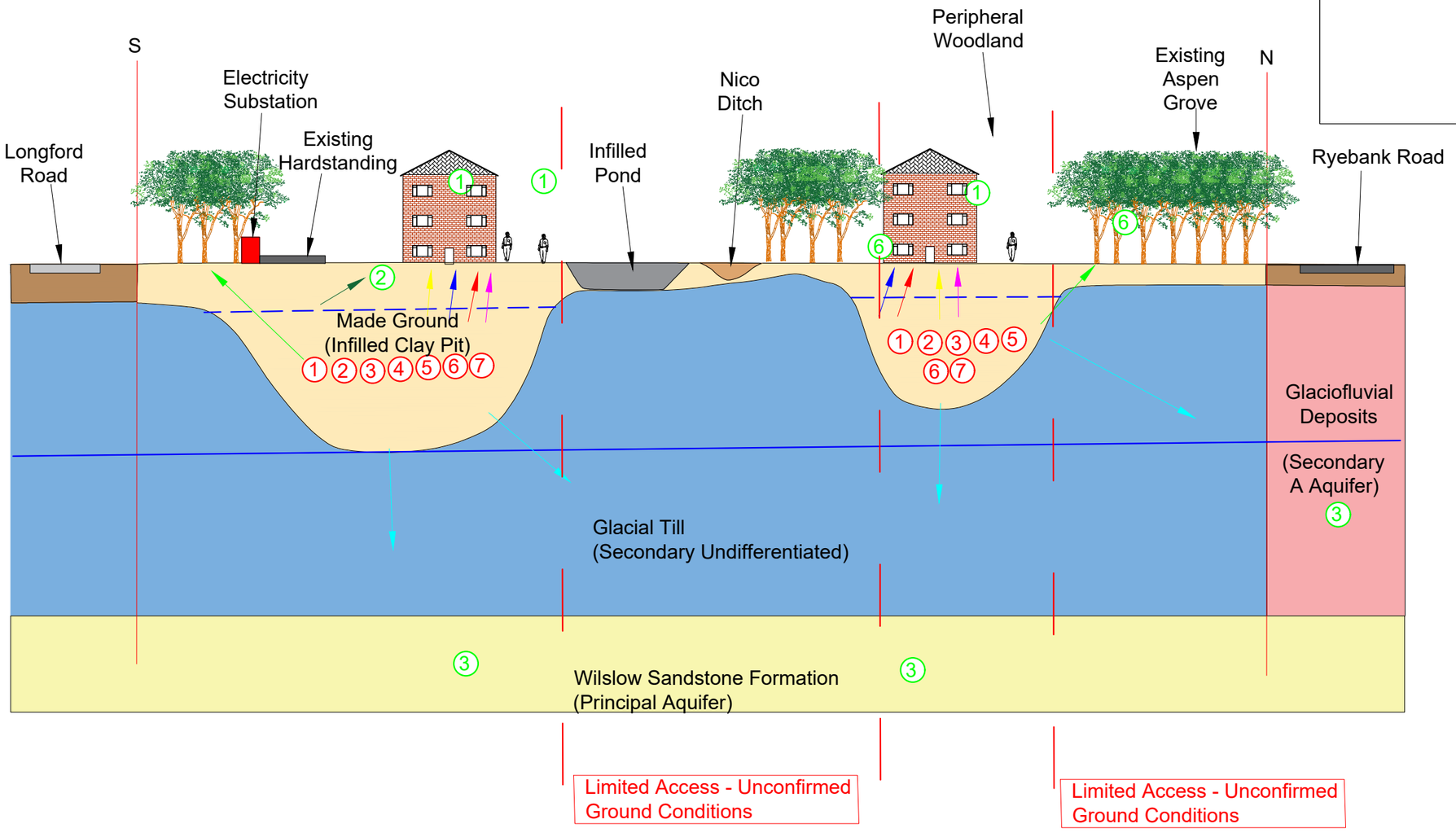
Job Title: Ryebank Fields

Drawing Title: Depth of Made Ground Plan

Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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Geology Key

- Made Ground
- Glacial Till
- Wilmslow Sandstone Formation
- Glacifluvial Deposits
- Perched Ground Water
- Assumed True Groundwater

Sources

1. Heavy Metals, Non Volatile PAH's, Non Volatile TPH's
2. Asbestos
3. Volatile Contaminants
4. Ground Gases
5. Mobile Contaminants (TPH, VOC)
6. Sulphate
7. Phytotoxic Contaminants

Pathways

- Dermal Contact / Ingestion
- Vapour Inhalation
- Inhalation / Accumulation
- Tainting of Water Supplies
- Dust Inhalation
- Vertical / Lateral Migration
- Sulphate Attack on Concrete
- Plant Uptake

Receptors

1. Future End Users
2. Water Pipes
3. Groundwater (Secondary B Aquifer)
4. Surface Water Features
5. Off-site Receptors
6. Building Structure
7. Flora

Notes:

Phase	Issue	Date	Drawn	Checked	
P1	REVA	24.03.2020	OW	ND	ND

Client: First Step Group Ltd

Job No: 17-403

Date: 24.10.2024

Drawing No: 010

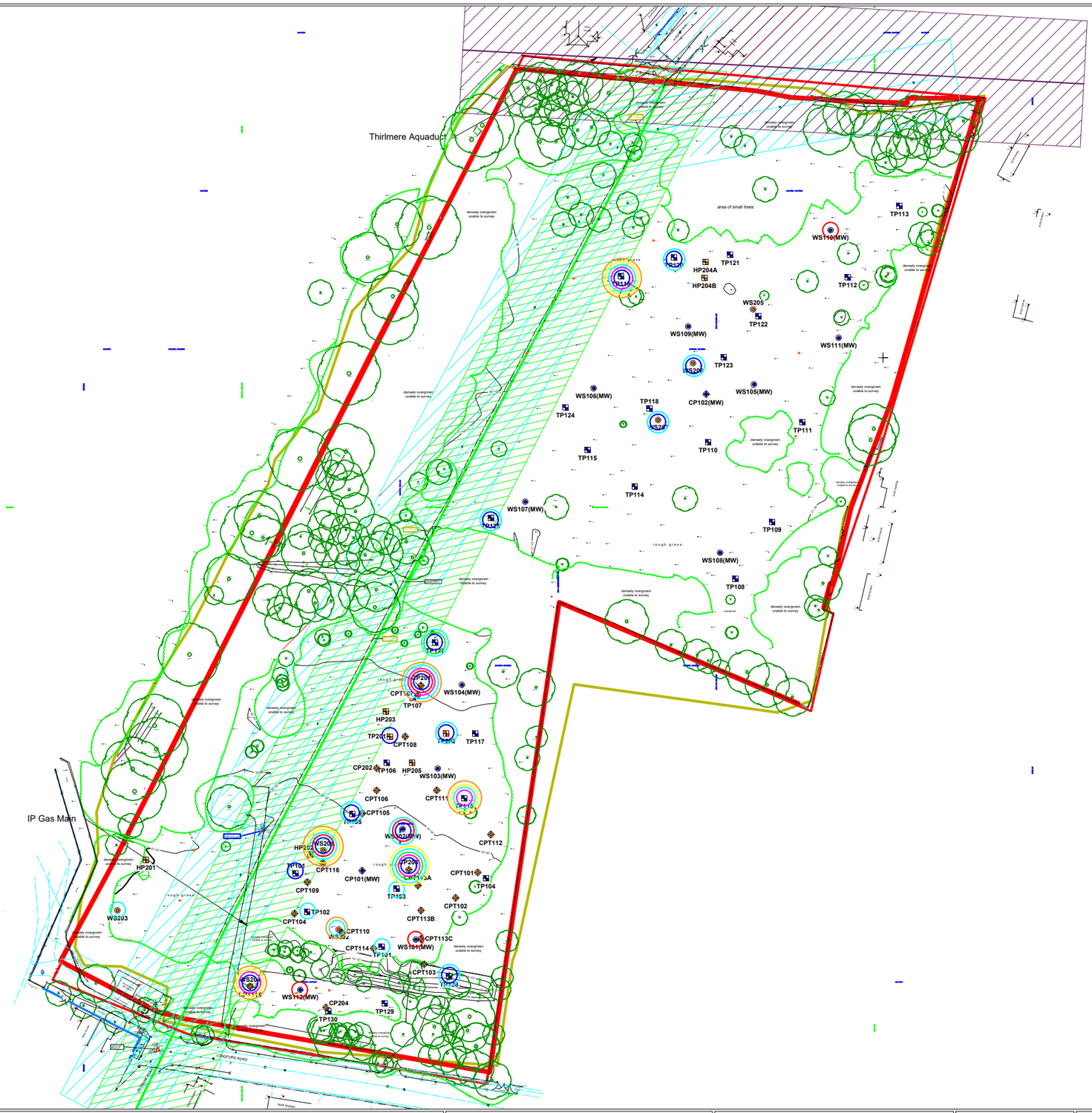
Scale: NTS

Job Title: Ryebank Fields

Drawing Title: Conceptual Site Model

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Location Symbols

- Approximate Window Sample Probehole Location (E3P Locations 2024)
- Approximate Trial Pit Location (E3P Locations 2024)
- Approximate Cable Percussive Borehole Location (E3P Locations 2024)
- Approximate Cone Penetrometer Test Location (E3P Locations 2024)
- Approximate Window Sample Probehole Location (E3P Locations 2019)
- Approximate Window Sample Probehole Location with Install (E3P Locations 2019)
- Approximate Trial Pit Location (E3P Locations 2019)
- Approximate Cable Percussive Borehole Location (E3P Locations 2019)

- IP Gas Pipe with 15m Easement
- Thirlmere Aquaduct with 20m Easement
- Sewer Easement with 15m Easement

Contamination Exceedances

- Heavy Metals
- Asbestos
- Mercury
- Naphthalene
- Non Volatile PAHs
- Volatile TPHs
- Non Volatile TPHs

Notes:

Client: First Step Group Ltd

Job No: 17-403

Date: 08.11.2024

Drawing No: 014

Scale: NTS@ A3

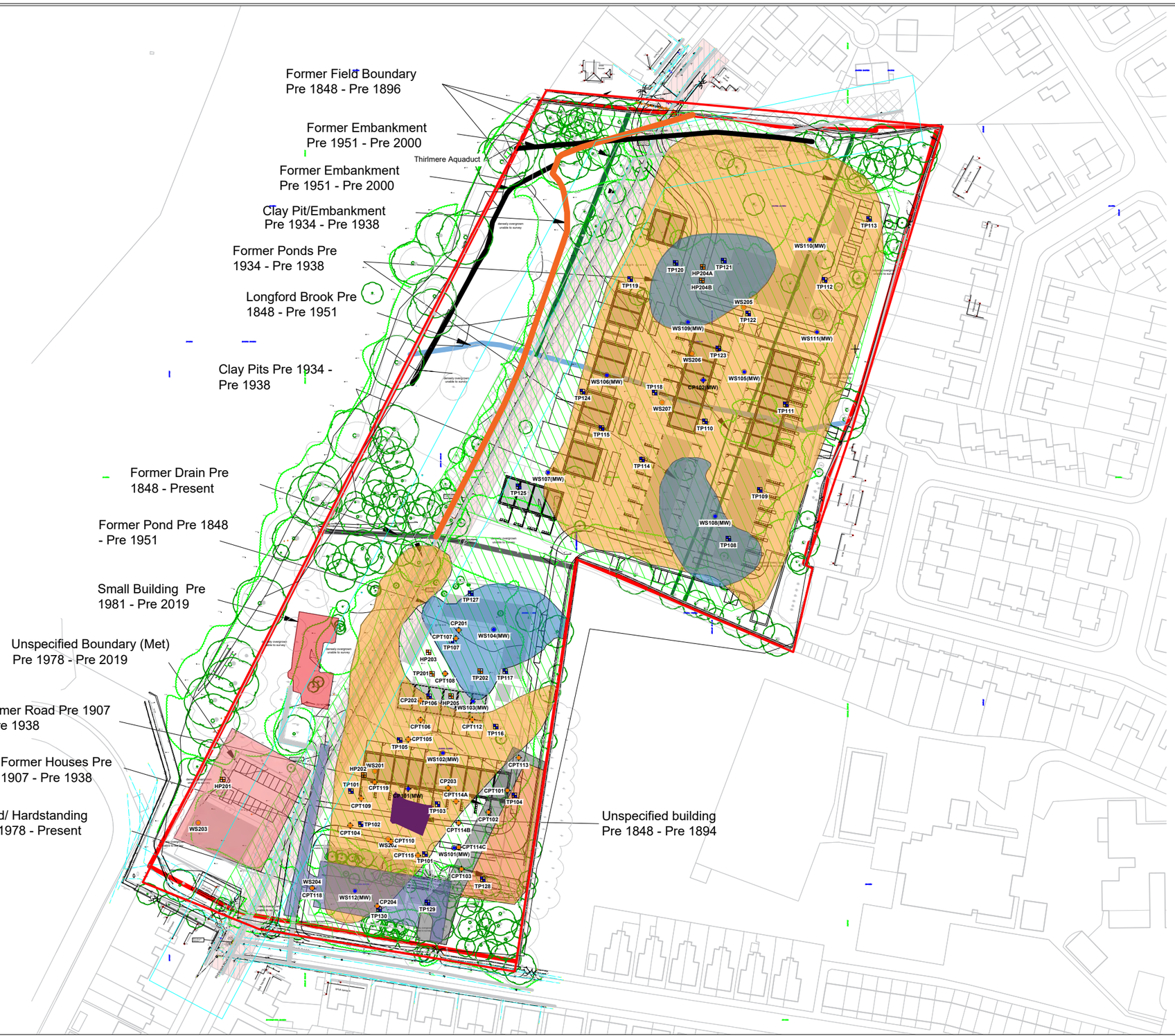
Phase	Issue	Date	Drawn	Checked	PM
P1	REVB	08.11.2024	OW	ND	ND
P1	REVA	10.10.2024	OW	ND	ND

Job Title: Ryebank Fields

Drawing Title: Contamination Exceedances Plan

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Historical Features

- Small Building Pre 1981 - Pre 2019
- Former Pond Pre 1848 - Pre 1951 / Pre 1934 - Pre 1938
- Former Houses Pre 1907 - Pre 1938
- Former Road Pre 1907 - Pre 1938
- Unspecified Building Pre - 1848 - Pre 1894
- Unspecified Boundary (Met) Pre 1978 - Pre 2019
- Former Clay Pits Pre 1934 - Pre 1938
- Road/Hardstanding Pre 1978 - Present
- Longford Brook Pre 1848 - Pre 1951
- Former Field Boundary Pre 1848 - Pre 1896
- Former Drain Pre 1848 - Present
- Former Embankment Pre 1951 - Pre 2000
- Former Clay pit/embankment Pre 1934 - Pre 1938
- BGS Recorded Mineral Site (Former Clay Pit)

Location Symbols

- Approximate Window Sample Probehole Location (E3P Locations 2024)
- Approximate Trial Pit Location (E3P Locations 2024)
- Approximate Cable Percussive Borehole Location (E3P Locations 2024)
- Approximate Cone Penetrometer Test Location (E3P Locations 2024)
- Approximate Window Sample Probehole Location (E3P Locations 2019)
- Approximate Window Sample Probehole Location with Install (E3P Locations 2019)
- Approximate Trial Pit Location (E3P Locations 2019)
- Approximate Cable Percussive Borehole Location (E3P Locations 2019)

Notes:

P1	REVA	24.10.2024	OW	ND	ND
Phase	Issue	Date	Drawn	Checked	PM

Client: First Step Group Ltd

Job Title: Ryebank Fields

Job No: 17-403

Date: 24.10.2024

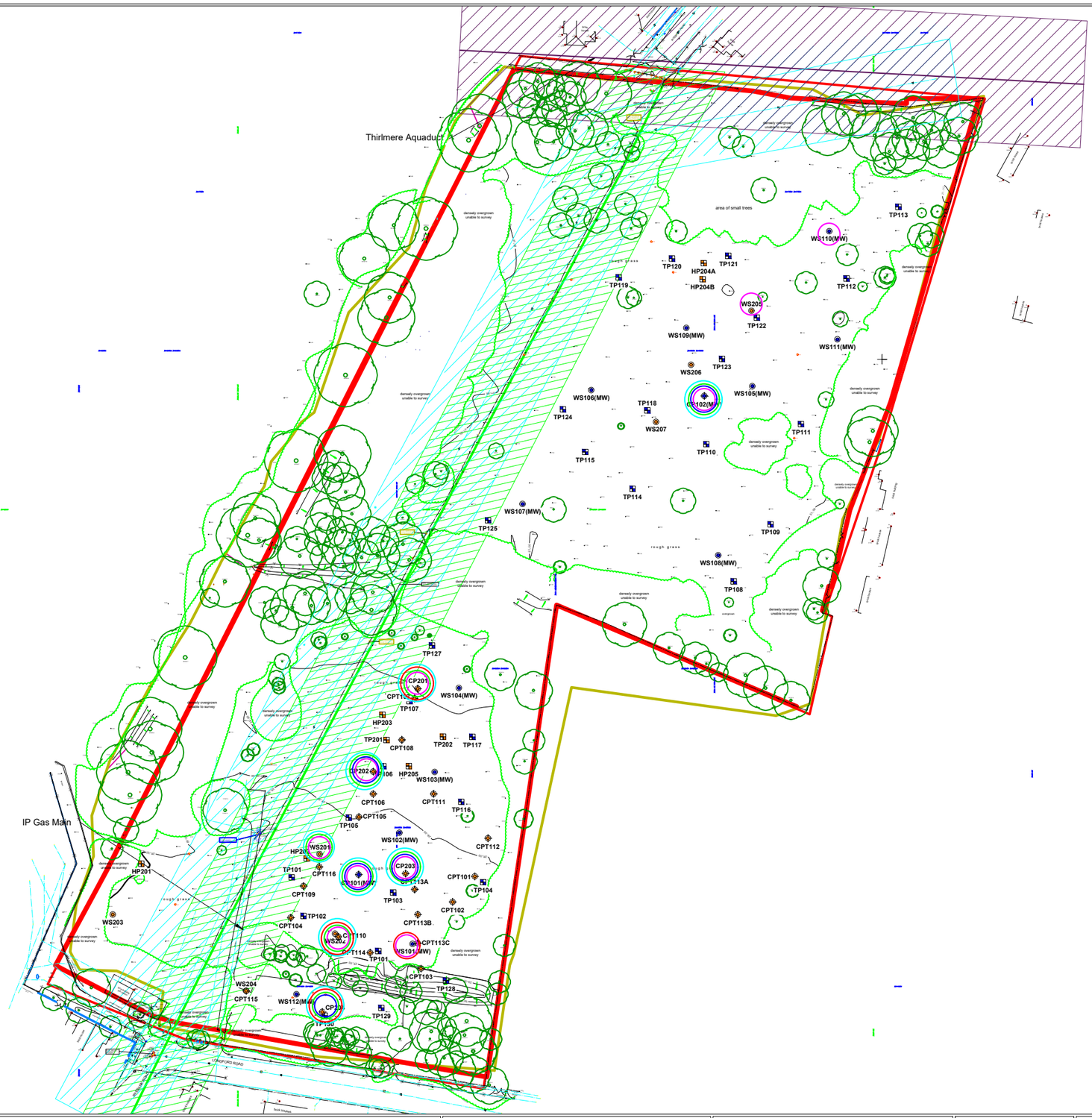
Drawing No: 024

Scale: NTS@ A3

Drawing Title: Historical Features, Proposed Development and Exploratory Hole Location Plan

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Location Symbols

- Approximate Window Sample Probehole Location (E3P Locations 2024)
- Approximate Trial Pit Location (E3P Locations 2024)
- Approximate Cable Percussive Borehole Location (E3P Locations 2024)
- Approximate Cone Penetrometer Test Location (E3P Locations 2024)
- Approximate Window Sample Probehole Location (E3P Locations 2019)
- Approximate Window Sample Probehole Location with Install (E3P Locations 2019)
- Approximate Trial Pit Location (E3P Locations 2019)
- Approximate Cable Percussive Borehole Location (E3P Locations 2019)

- IP Gas Pipe with 15m Easement
- Thirlmere Aquaduct with 20m Easement
- Sewer Easement with 15m Easement

Controlled Waters Exceedances

- VOCs
- Heavy Metals
- TPHs
- PAHs
- Naphthalene

Notes:

Client: First Step Group Ltd

Job No: 17-403

Date: 08.11.2024

Drawing No: 027

Scale: NTS@ A3

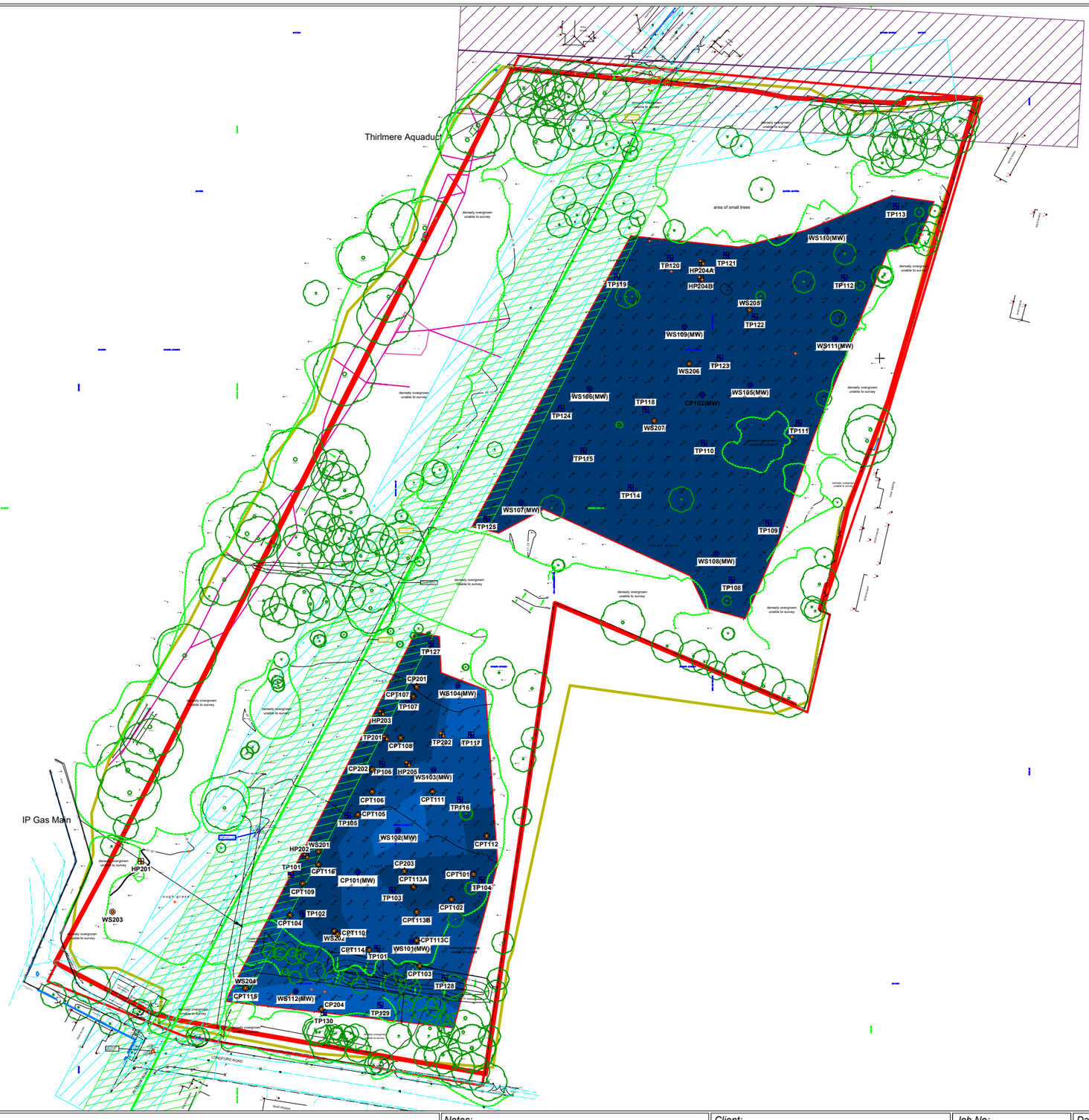
P1	REVB	08.11.2024	OW	ND	ND
P1	REVA	30.10.2024	OW	ND	ND
Phase	Issue	Date	Drawn	Checked	PM

Job Title: Ryebank Fields

Drawing Title: Controlled Waters Contamination Exceedances Plan

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Location Symbols

- Approximate Window Sample Probehole Location (E3P Locations 2024)
- Approximate Trial Pit Location (E3P Locations 2024)
- Approximate Cable Percussive Borehole Location (E3P Locations 2024)
- Approximate Cone Penetrometer Test Location (E3P Locations 2024)
- Approximate Window Sample Probehole Location (E3P Locations 2019)
- Approximate Window Sample Probehole Location with Install (E3P Locations 2019)
- Approximate Trial Pit Location (E3P Locations 2019)
- Approximate Cable Percussive Borehole Location (E3P Locations 2019)

- IP Gas Pipe with 15m Easement
- Thirlmere Aquaduct with 20m Easement
- Sewer Easement with 15m Easement

Groundwater Depth (m AOD)

- Depth of Groundwater 25.00 - 25.99m
- Depth of Groundwater 26.00 - 26.99m
- Depth of Groundwater >27.00m

Notes:

Client: First Step Group Ltd

Job No: 17-403

Date: 28.11.2024

Drawing No: 028

Scale: NTS@ A3

Phase	Issue	Date	Drawn	Checked	PM
P1	REVA	28.11.2024	OW	NS	NS

Job Title: Ryebank Fields

Drawing Title: Depth of Ground Water Flow Plan

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APPENDIX II
RTM SHEETS



Source Area 1 – Infilled Clay Pit (Northern Sector)

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Arsenic**			
Target Concentration (C_T)	**0.01**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Arsenic**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.00E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Arsenic**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.51E+01**		
Level 2 Remedial Target		**1.51E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		7.57E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Arsenic		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		32	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	3.81E-06	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	6.40E-02	mg/l

Remedial Targets

Level 3 Remedial Target		**1.51E-01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		7.57E+01	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	5.00E+02	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

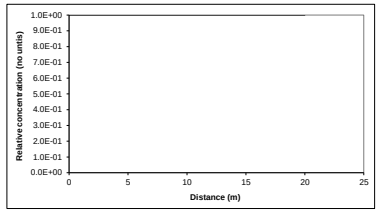
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	4.23E-03
1.0	1.00E+00	4.23E-03
2.0	1.00E+00	4.23E-03
3.0	1.00E+00	4.23E-03
4.0	1.00E+00	4.23E-03
5.0	1.00E+00	4.23E-03
6.0	1.00E+00	4.23E-03
7.0	1.00E+00	4.23E-03
8.0	1.00E+00	4.23E-03
9.0	1.00E+00	4.23E-03
10.0	1.00E+00	4.23E-03
11.0	1.00E+00	4.23E-03
12.0	1.00E+00	4.23E-03
13.0	1.00E+00	4.23E-03
14.0	1.00E+00	4.23E-03
15.0	1.00E+00	4.23E-03
16.0	1.00E+00	4.23E-03
17.0	1.00E+00	4.23E-03
18.0	1.00E+00	4.23E-03
19.0	1.00E+00	4.23E-03
20.0	1.00E+00	4.23E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Copper**			
Target Concentration (C_T)	**2**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Copper**		
Target concentration	C_T	**2**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.00E+02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	2	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Copper**		from Level 1
Target concentration	C_T	**2**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.53E+01**		
Level 2 Remedial Target		**3.06E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.06E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Copper		from Level 1
Target Concentration	C_T	2	mg/l	from Level 1
Dilution Factor	DF	1.53E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		620	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	2.20E+02	fraction
Decay rate used	λ	3.16E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	1.89E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	6.19E+00	mg/l

Remedial Targets

Level 3 Remedial Target		**3.06E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		3.06E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	1.00E+02	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction

Soil water partition coefficient	Kd	1.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

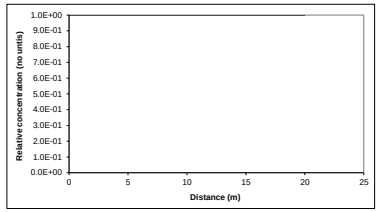
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	4.05E-01
1.0	1.00E+00	4.05E-01
2.0	1.00E+00	4.05E-01
3.0	1.00E+00	4.05E-01
4.0	1.00E+00	4.05E-01
5.0	1.00E+00	4.05E-01
6.0	1.00E+00	4.05E-01
7.0	1.00E+00	4.05E-01
8.0	1.00E+00	4.05E-01
9.0	1.00E+00	4.05E-01
10.0	1.00E+00	4.05E-01
11.0	1.00E+00	4.05E-01
12.0	1.00E+00	4.05E-01
13.0	1.00E+00	4.05E-01
14.0	1.00E+00	4.05E-01
15.0	1.00E+00	4.05E-01
16.0	1.00E+00	4.05E-01
17.0	1.00E+00	4.05E-01
18.0	1.00E+00	4.05E-01
19.0	1.00E+00	4.05E-01
20.0	1.00E+00	4.05E-01

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Cyanide**			
Target Concentration (C_T)	**0.05**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Cyanide**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**1.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.01E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Cyanide**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.52E+01**		
Level 2 Remedial Target		**7.62E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		7.64E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Cyanide		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	1.52E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		120	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	2.20E+02	fraction
Decay rate used	λ	3.16E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	1.89E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_O/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	1.20E+00	mg/l

Remedial Targets

Level 3 Remedial Target		**7.62E-01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		7.64E+01	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	1.00E+02	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{w,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

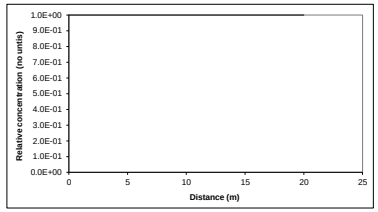
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	7.85E-02
1.0	1.00E+00	7.85E-02
2.0	1.00E+00	7.85E-02
3.0	1.00E+00	7.85E-02
4.0	1.00E+00	7.85E-02
5.0	1.00E+00	7.85E-02
6.0	1.00E+00	7.85E-02
7.0	1.00E+00	7.85E-02
8.0	1.00E+00	7.85E-02
9.0	1.00E+00	7.85E-02
10.0	1.00E+00	7.85E-02
11.0	1.00E+00	7.85E-02
12.0	1.00E+00	7.85E-02
13.0	1.00E+00	7.85E-02
14.0	1.00E+00	7.85E-02
15.0	1.00E+00	7.85E-02
16.0	1.00E+00	7.85E-02
17.0	1.00E+00	7.85E-02
18.0	1.00E+00	7.85E-02
19.0	1.00E+00	7.85E-02
20.0	1.00E+00	7.85E-02

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Lead**			
Target Concentration (C_T)	**0.01**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Lead**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*Esitmate*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.00E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Lead**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.51E+01**		
Level 2 Remedial Target		**1.51E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		7.57E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Lead		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1000	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	3.81E-06	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	2.00E+00	mg/l

Remedial Targets

Level 3 Remedial Target		**1.51E-01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		7.57E+01	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

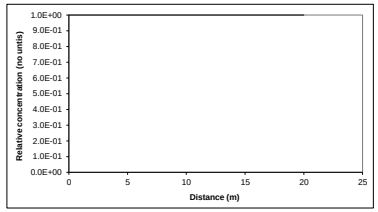
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	1.32E-01
1.0	1.00E+00	1.32E-01
2.0	1.00E+00	1.32E-01
3.0	1.00E+00	1.32E-01
4.0	1.00E+00	1.32E-01
5.0	1.00E+00	1.32E-01
6.0	1.00E+00	1.32E-01
7.0	1.00E+00	1.32E-01
8.0	1.00E+00	1.32E-01
9.0	1.00E+00	1.32E-01
10.0	1.00E+00	1.32E-01
11.0	1.00E+00	1.32E-01
12.0	1.00E+00	1.32E-01
13.0	1.00E+00	1.32E-01
14.0	1.00E+00	1.32E-01
15.0	1.00E+00	1.32E-01
16.0	1.00E+00	1.32E-01
17.0	1.00E+00	1.32E-01
18.0	1.00E+00	1.32E-01
19.0	1.00E+00	1.32E-01
20.0	1.00E+00	1.32E-01

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Naphthalene			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Naphthalene**		
Target concentration	**C_T**	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	6.62E-03	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.46E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.93E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**3.95E-01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Naphthalene**		from Level 1
Target concentration	**C_T**	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.51E+01**		
Level 2 Remedial Target		**1.51E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		5.98E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Naphthalene		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.72	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.58E+02	days	*Howard et al*
Calculated decay rate	λ	2.69E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.93E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	8.69E+01	fraction
Decay rate used	λ	3.09E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	4.79E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.03E-04	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.66E+03**	**fraction**
Calculated soil leachate concentration	Co	1.82E-02	mg/l

Remedial Targets

Level 3 Remedial Target	**2.51E+02**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	9.93E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration	**C_{ED}/C_0** **6.03E-04**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	6.46E+02	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.93E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

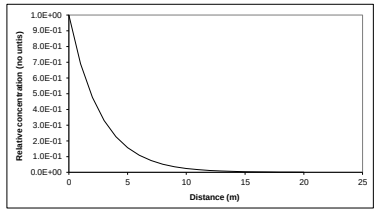
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.20E-03
1.0	6.90E-01	8.31E-04
2.0	4.76E-01	5.73E-04
3.0	3.29E-01	3.96E-04
4.0	2.27E-01	2.73E-04
5.0	1.57E-01	1.89E-04
6.0	1.08E-01	1.30E-04
7.0	7.46E-02	8.98E-05
8.0	5.15E-02	6.20E-05
9.0	3.56E-02	4.28E-05
10.0	2.45E-02	2.95E-05
11.0	1.69E-02	2.04E-05
12.0	1.17E-02	1.41E-05
13.0	8.07E-03	9.72E-06
14.0	5.57E-03	6.71E-06
15.0	3.85E-03	4.63E-06
16.0	2.65E-03	3.20E-06
17.0	1.83E-03	2.21E-06
18.0	1.26E-03	1.52E-06
19.0	8.73E-04	1.05E-06
20.0	6.03E-04	7.25E-07

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Nickel			
Target Concentration (C_T)	0.02	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Nickel**		
Target concentration	C_T	**0.02**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.00E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.02	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Nickel**		from Level 1
Target concentration	C_T	**0.02**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.52E+01**		
Level 2 Remedial Target		**3.04E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.52E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Nickel		from Level 1
Target Concentration	C_T	0.02	mg/l	from Level 1
Dilution Factor	DF	1.52E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		33	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	3.80E-06	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	6.60E-02	mg/l

Remedial Targets

Level 3 Remedial Target	**3.04E-01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.52E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction

Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

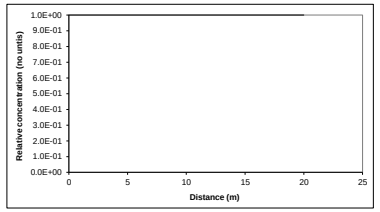
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	4.34E-03
1.0	1.00E+00	4.34E-03
2.0	1.00E+00	4.34E-03
3.0	1.00E+00	4.34E-03
4.0	1.00E+00	4.34E-03
5.0	1.00E+00	4.34E-03
6.0	1.00E+00	4.34E-03
7.0	1.00E+00	4.34E-03
8.0	1.00E+00	4.34E-03
9.0	1.00E+00	4.34E-03
10.0	1.00E+00	4.34E-03
11.0	1.00E+00	4.34E-03
12.0	1.00E+00	4.34E-03
13.0	1.00E+00	4.34E-03
14.0	1.00E+00	4.34E-03
15.0	1.00E+00	4.34E-03
16.0	1.00E+00	4.34E-03
17.0	1.00E+00	4.34E-03
18.0	1.00E+00	4.34E-03
19.0	1.00E+00	4.34E-03
20.0	1.00E+00	4.34E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Phenol			
Target Concentration (C_T)	0.0077	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Phenol**		
Target concentration	C_T	**0.0077**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	8.35E-06	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	2.88E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.76E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.51E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0077	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Phenol**		from Level 1	This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).
Target concentration	**C_T**	**0.0077**	**mg/l**	from Level 1	

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.51E+01**		
Level 2 Remedial Target		**1.16E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.28E-01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters

Input Parameters	Variable	Value	Unit	Source
Contaminant		Phenol		from Level 1
Target Concentration	C_T	0.0077	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.5	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.80E+01	days	*Howard et al*
Calculated decay rate	λ	2.48E-02	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.76E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Calculated Parameters	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	4.84E+00	fraction
Decay rate used	λ	5.12E-03	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	8.60E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.09E-13	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**9.19E+12**	**fraction**
Calculated soil leachate concentration	Co	2.55E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**1.07E+12**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		2.09E+12	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.09E-13**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	2.88E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.76E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

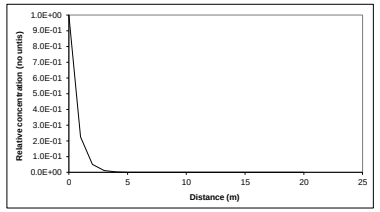
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.69E-02
1.0	2.25E-01	3.80E-03
2.0	5.05E-02	8.54E-04
3.0	1.14E-02	1.92E-04
4.0	2.55E-03	4.32E-05
5.0	5.74E-04	9.71E-06
6.0	1.29E-04	2.18E-06
7.0	2.90E-05	4.91E-07
8.0	6.53E-06	1.10E-07
9.0	1.47E-06	2.48E-08
10.0	3.30E-07	5.58E-09
11.0	7.42E-08	1.25E-09
12.0	1.67E-08	2.82E-10
13.0	3.75E-09	6.34E-11
14.0	8.43E-10	1.42E-11
15.0	1.89E-10	3.20E-12
16.0	4.26E-11	7.20E-13
17.0	9.58E-12	1.62E-13
18.0	2.15E-12	3.64E-14
19.0	4.84E-13	8.18E-15
20.0	1.09E-13	1.84E-15

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	TPH Aromatic C5-C7			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C5-C7**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.16E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.76E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**4.12E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.35E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C5-C7**		from Level 1
Target concentration	**C_T**	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.51E+01**		
Level 2 Remedial Target		**1.51E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		6.58E-01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C5-C7		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	7.30E+02	days	*Howard et al*
Calculated decay rate	λ	9.50E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.12E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	1.00E+01	fraction
Decay rate used	λ	9.50E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	4.16E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	3.32E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**3.01E+01**	**fraction**
Calculated soil leachate concentration	Co	2.30E-01	mg/l

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	6.76E+01	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	4.12E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

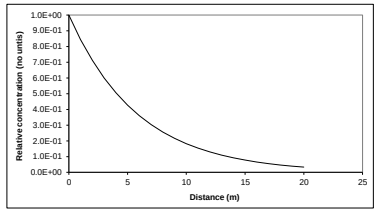
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.52E-02
1.0	8.43E-01	1.28E-02
2.0	7.11E-01	1.08E-02
3.0	6.00E-01	9.11E-03
4.0	5.06E-01	7.69E-03
5.0	4.27E-01	6.48E-03
6.0	3.60E-01	5.47E-03
7.0	3.04E-01	4.61E-03
8.0	2.56E-01	3.89E-03
9.0	2.16E-01	3.28E-03
10.0	1.82E-01	2.77E-03
11.0	1.54E-01	2.34E-03
12.0	1.30E-01	1.97E-03
13.0	1.09E-01	1.66E-03
14.0	9.23E-02	1.40E-03
15.0	7.78E-02	1.18E-03
16.0	6.56E-02	9.97E-04
17.0	5.54E-02	8.41E-04
18.0	4.67E-02	7.09E-04
19.0	3.94E-02	5.98E-04
20.0	3.32E-02	5.05E-04

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Remedial Targets

Level 3 Remedial Target		**4.55E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.98E+01	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**3.32E-02**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	TPH Aromatic C8-C10			
Target Concentration (C_T)	0.3	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C8-C10**		
Target concentration	C_T	**0.3**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	2.53E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	1.58E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**9.65E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.90E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.3	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C8-C10**		from Level 1
Target concentration	**C_T**	**0.3**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.53E+01**		
Level 2 Remedial Target		**4.58E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		4.43E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C8-C10		from Level 1
Target Concentration	C_T	0.3	mg/l	from Level 1
Dilution Factor	DF	1.53E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		29	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.28E+02	days	*Howard et al*
Calculated decay rate	λ	3.04E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.65E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	2.12E+02	fraction
Decay rate used	λ	1.43E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	1.96E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	3.08E-04	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**3.24E+03**	**fraction**
Calculated soil leachate concentration	Co	3.00E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**1.49E+04**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.44E+06	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**3.08E-04**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	1.58E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.65E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

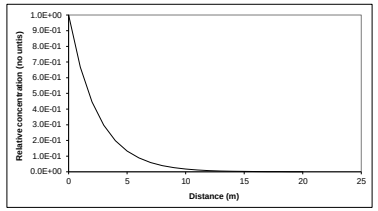
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.96E-02
1.0	6.68E-01	1.31E-02
2.0	4.46E-01	8.74E-03
3.0	2.97E-01	5.83E-03
4.0	1.99E-01	3.89E-03
5.0	1.33E-01	2.60E-03
6.0	8.85E-02	1.74E-03
7.0	5.90E-02	1.16E-03
8.0	3.94E-02	7.73E-04
9.0	2.63E-02	5.16E-04
10.0	1.76E-02	3.45E-04
11.0	1.17E-02	2.30E-04
12.0	7.82E-03	1.54E-04
13.0	5.22E-03	1.02E-04
14.0	3.49E-03	6.84E-05
15.0	2.33E-03	4.57E-05
16.0	1.55E-03	3.05E-05
17.0	1.04E-03	2.03E-05
18.0	6.92E-04	1.36E-05
19.0	4.62E-04	9.06E-06
20.0	3.08E-04	6.05E-06

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**TPH Aromatic C10-C12**			
Target Concentration (C_T)	**0.09**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C10-C12**		
Target concentration	**C_T**	**0.09**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	7.22E-02	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	2.51E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.53E+02**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.38E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.09	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C10-C12**		from Level 1
Target concentration	**C_T**	**0.09**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.53E+01**		
Level 2 Remedial Target		**1.37E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.10E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C10-C12		from Level 1
Target Concentration	C_T	0.09	mg/l	from Level 1
Dilution Factor	DF	1.53E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		20	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.58E+02	days	*Howard et al*
Calculated decay rate	λ	2.69E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.53E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	3.35E+02	fraction
Decay rate used	λ	8.01E-06	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	1.24E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.01E-04	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.66E+03**	**fraction**
Calculated soil leachate concentration	Co	1.31E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**2.29E+03**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	3.50E+05	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**6.01E-04**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	2.51E+03	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.53E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

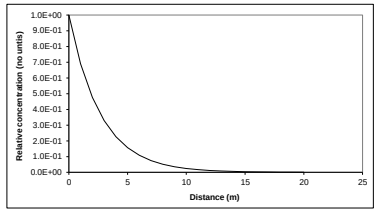
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	8.55E-03
1.0	6.90E-01	5.90E-03
2.0	4.76E-01	4.07E-03
3.0	3.29E-01	2.81E-03
4.0	2.27E-01	1.94E-03
5.0	1.57E-01	1.34E-03
6.0	1.08E-01	9.24E-04
7.0	7.46E-02	6.38E-04
8.0	5.15E-02	4.40E-04
9.0	3.55E-02	3.04E-04
10.0	2.45E-02	2.10E-04
11.0	1.69E-02	1.45E-04
12.0	1.17E-02	9.99E-05
13.0	8.06E-03	6.89E-05
14.0	5.56E-03	4.76E-05
15.0	3.84E-03	3.28E-05
16.0	2.65E-03	2.27E-05
17.0	1.83E-03	1.56E-05
18.0	1.26E-03	1.08E-05
19.0	8.71E-04	7.45E-06
20.0	6.01E-04	5.14E-06

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Zinc			
Target Concentration (C_T)	0.0109	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Zinc**		
Target concentration	**C_T**	**0.0109**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	3.80E+01	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.80E+01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.16E-01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0109	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Zinc**		from Level 1
Target concentration	**C_T**	**0.0109**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.62E+04	m^2	**90 m x 180 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.80E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	9.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.80E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**1.51E+01**		
Level 2 Remedial Target		**1.65E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		6.31E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Zinc		from Level 1
Target Concentration	C_T	0.0109	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1000	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	9.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.80E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.53E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.80E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	4.16E-03	m/d
Retardation factor	Rf	8.40E+01	fraction
Decay rate used	λ	8.25E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.53E-04	fraction
Rate of contaminant flow due to retardation	u	4.95E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	2.62E+01	mg/l

Remedial Targets

Level 3 Remedial Target		**1.65E-01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		6.31E+00	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		**20**	**m**	
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	3.80E+01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.80E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

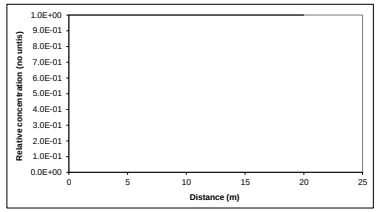
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.73E+00
1.0	1.00E+00	1.73E+00
2.0	1.00E+00	1.73E+00
3.0	1.00E+00	1.73E+00
4.0	1.00E+00	1.73E+00
5.0	1.00E+00	1.73E+00
6.0	1.00E+00	1.73E+00
7.0	1.00E+00	1.73E+00
8.0	1.00E+00	1.73E+00
9.0	1.00E+00	1.73E+00
10.0	1.00E+00	1.73E+00
11.0	1.00E+00	1.73E+00
12.0	1.00E+00	1.73E+00
13.0	1.00E+00	1.73E+00
14.0	1.00E+00	1.73E+00
15.0	1.00E+00	1.73E+00
16.0	1.00E+00	1.73E+00
17.0	1.00E+00	1.73E+00
18.0	1.00E+00	1.73E+00
19.0	1.00E+00	1.73E+00
20.0	1.00E+00	1.73E+00

Source Area 1 – (10 m x 10 m grid)

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Arsenic			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Arsenic**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.00E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Arsenic**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.13E+02**		
Level 2 Remedial Target		**2.13E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.07E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Arsenic		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	2.13E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		32	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	3.57E-06	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	6.40E-02	mg/l

Remedial Targets

Level 3 Remedial Target		**2.31E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.15E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	5.00E+02	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{w,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

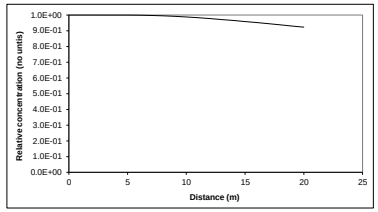
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	3.00E-04
1.0	1.00E+00	3.00E-04
2.0	1.00E+00	3.00E-04
3.0	1.00E+00	3.00E-04
4.0	1.00E+00	3.00E-04
5.0	1.00E+00	3.00E-04
6.0	9.99E-01	3.00E-04
7.0	9.97E-01	2.99E-04
8.0	9.95E-01	2.99E-04
9.0	9.92E-01	2.98E-04
10.0	9.88E-01	2.97E-04
11.0	9.83E-01	2.95E-04
12.0	9.78E-01	2.94E-04
13.0	9.72E-01	2.92E-04
14.0	9.65E-01	2.90E-04
15.0	9.59E-01	2.88E-04
16.0	9.52E-01	2.86E-04
17.0	9.45E-01	2.84E-04
18.0	9.38E-01	2.82E-04
19.0	9.30E-01	2.79E-04
20.0	9.23E-01	2.77E-04

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Copper**			
Target Concentration (C_T)	**2**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Copper**		
Target concentration	C_T	**2**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**1.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.00E+02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	2	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Copper**		from Level 1
Target concentration	C_T	**2**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.15E+02**		
Level 2 Remedial Target		**4.30E+02**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		4.31E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Copper		from Level 1
Target Concentration	C_T	2	mg/l	from Level 1
Dilution Factor	DF	2.15E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		620	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	2.20E+02	fraction
Decay rate used	λ	3.16E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	1.78E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	6.19E+00	mg/l

Remedial Targets

Level 3 Remedial Target	**4.66E+02**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	4.67E+04	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 1.00E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction
Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg
Sorption coefficient for ionised species — $K_{w,i}$ — l/kg
pH value — pH
Acid dissociation constant — pKa
Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 1.00E+02 — l/kg

Define dispersivity (click brown cell and use pull down list)

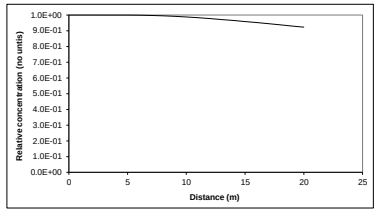
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.88E-02
1.0	1.00E+00	2.88E-02
2.0	1.00E+00	2.88E-02
3.0	1.00E+00	2.88E-02
4.0	1.00E+00	2.88E-02
5.0	1.00E+00	2.87E-02
6.0	9.99E-01	2.87E-02
7.0	9.97E-01	2.87E-02
8.0	9.95E-01	2.86E-02
9.0	9.92E-01	2.85E-02
10.0	9.88E-01	2.84E-02
11.0	9.83E-01	2.83E-02
12.0	9.78E-01	2.81E-02
13.0	9.72E-01	2.79E-02
14.0	9.65E-01	2.78E-02
15.0	9.59E-01	2.76E-02
16.0	9.52E-01	2.74E-02
17.0	9.45E-01	2.72E-02
18.0	9.38E-01	2.70E-02
19.0	9.30E-01	2.68E-02
20.0	9.23E-01	2.65E-02

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Cyanide**			
Target Concentration (C_T)	**0.05**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Cyanide**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**1.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.01E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Cyanide**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.15E+02**		
Level 2 Remedial Target		**1.07E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.08E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Cyanide		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	2.15E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		120	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	2.20E+02	fraction
Decay rate used	λ	3.16E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	1.78E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	1.20E+00	mg/l

Remedial Targets

Level 3 Remedial Target	**1.16E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.17E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	1.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

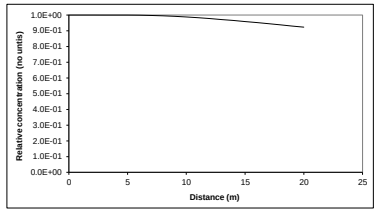
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	5.58E-03
1.0	1.00E+00	5.58E-03
2.0	1.00E+00	5.58E-03
3.0	1.00E+00	5.58E-03
4.0	1.00E+00	5.58E-03
5.0	1.00E+00	5.57E-03
6.0	9.99E-01	5.57E-03
7.0	9.97E-01	5.56E-03
8.0	9.95E-01	5.55E-03
9.0	9.92E-01	5.53E-03
10.0	9.88E-01	5.51E-03
11.0	9.83E-01	5.48E-03
12.0	9.78E-01	5.45E-03
13.0	9.72E-01	5.42E-03
14.0	9.65E-01	5.38E-03
15.0	9.59E-01	5.35E-03
16.0	9.52E-01	5.31E-03
17.0	9.45E-01	5.27E-03
18.0	9.38E-01	5.23E-03
19.0	9.30E-01	5.19E-03
20.0	9.23E-01	5.15E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Lead**			
Target Concentration (C_T)	**0.01**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Lead**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*Esitmate*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.00E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Lead**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.13E+02**		
Level 2 Remedial Target		**2.13E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.07E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Lead		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	2.13E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1000	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	3.57E-06	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	2.00E+00	mg/l

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 5.00E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction

Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{w,i}$ — l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 5.00E+02 — l/kg

Define dispersivity (click brown cell and use pull down list)

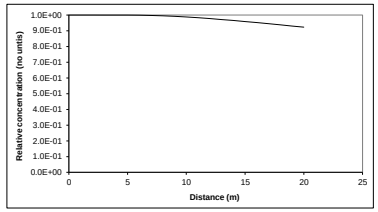
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	9.38E-03
1.0	1.00E+00	9.38E-03
2.0	1.00E+00	9.38E-03
3.0	1.00E+00	9.38E-03
4.0	1.00E+00	9.38E-03
5.0	1.00E+00	9.38E-03
6.0	9.99E-01	9.37E-03
7.0	9.97E-01	9.36E-03
8.0	9.95E-01	9.34E-03
9.0	9.92E-01	9.31E-03
10.0	9.88E-01	9.27E-03
11.0	9.83E-01	9.22E-03
12.0	9.78E-01	9.17E-03
13.0	9.72E-01	9.12E-03
14.0	9.65E-01	9.06E-03
15.0	9.59E-01	9.00E-03
16.0	9.52E-01	8.93E-03
17.0	9.45E-01	8.87E-03
18.0	9.38E-01	8.80E-03
19.0	9.30E-01	8.73E-03
20.0	9.23E-01	8.66E-03

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank		
Completed by:	Nicola Sellars		
Date:	########		
Version:	1		

Remedial Targets

Level 3 Remedial Target	**2.31E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.15E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.23E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Naphthalene			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Naphthalene**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	6.62E-03	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.46E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.93E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**3.95E-01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Naphthalene**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.13E+02**		
Level 2 Remedial Target		**2.13E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		8.42E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Naphthalene		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	2.13E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.72	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.58E+02	days	*Howard et al*
Calculated decay rate	λ	2.69E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.93E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	8.69E+01	fraction
Decay rate used	λ	3.09E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	4.49E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	3.97E-04	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**2.52E+03**	**fraction**
Calculated soil leachate concentration	Co	1.82E-02	mg/l

Remedial Targets

Level 3 Remedial Target	**5.37E+03**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	2.12E+05	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**3.97E-04**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	6.46E+02	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.93E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

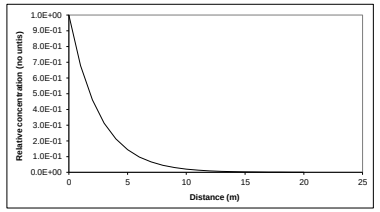
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	8.55E-05
1.0	6.79E-01	5.80E-05
2.0	4.61E-01	3.94E-05
3.0	3.13E-01	2.67E-05
4.0	2.12E-01	1.81E-05
5.0	1.44E-01	1.23E-05
6.0	9.76E-02	8.35E-06
7.0	6.62E-02	5.66E-06
8.0	4.48E-02	3.83E-06
9.0	3.03E-02	2.59E-06
10.0	2.05E-02	1.75E-06
11.0	1.38E-02	1.18E-06
12.0	9.34E-03	7.99E-07
13.0	6.30E-03	5.39E-07
14.0	4.25E-03	3.63E-07
15.0	2.86E-03	2.45E-07
16.0	1.93E-03	1.65E-07
17.0	1.30E-03	1.11E-07
18.0	8.75E-04	7.49E-08
19.0	5.90E-04	5.04E-08
20.0	3.97E-04	3.39E-08

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Nickel			
Target Concentration (C_T)	0.02	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Nickel**		
Target concentration	C_T	**0.02**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.00E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.02	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Nickel**		from Level 1
Target concentration	C_T	**0.02**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**100 m x 100 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.14E+02**		
Level 2 Remedial Target		**4.28E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.14E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Nickel		from Level 1
Target Concentration	C_T	0.02	mg/l	from Level 1
Dilution Factor	DF	2.14E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		33	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	3.57E-06	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	6.60E-02	mg/l

Remedial Targets

Level 3 Remedial Target	**4.64E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	2.32E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

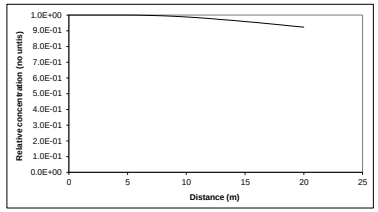
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	3.08E-04
1.0	1.00E+00	3.08E-04
2.0	1.00E+00	3.08E-04
3.0	1.00E+00	3.08E-04
4.0	1.00E+00	3.08E-04
5.0	1.00E+00	3.08E-04
6.0	9.99E-01	3.08E-04
7.0	9.97E-01	3.07E-04
8.0	9.95E-01	3.07E-04
9.0	9.92E-01	3.06E-04
10.0	9.88E-01	3.04E-04
11.0	9.83E-01	3.03E-04
12.0	9.78E-01	3.01E-04
13.0	9.72E-01	2.99E-04
14.0	9.65E-01	2.97E-04
15.0	9.59E-01	2.95E-04
16.0	9.52E-01	2.93E-04
17.0	9.45E-01	2.91E-04
18.0	9.38E-01	2.89E-04
19.0	9.30E-01	2.87E-04
20.0	9.23E-01	2.84E-04

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Phenol			
Target Concentration (C_T)	0.0077	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Phenol**		
Target concentration	C_T	**0.0077**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	8.35E-06	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	2.88E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**1.76E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.51E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0077	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Phenol**		from Level 1
Target concentration	C_T	**0.0077**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.12E+02**		
Level 2 Remedial Target		**1.64E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.20E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Phenol		from Level 1
Target Concentration	C_T	0.0077	mg/l	from Level 1
Dilution Factor	DF	2.12E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.5	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.80E+01	days	*Howard et al*
Calculated decay rate	λ	2.48E-02	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.76E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	3.91E-03	m/d
Retardation factor	Rf	4.84E+00	fraction
Decay rate used	λ	5.12E-03	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	8.07E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	3.32E-14	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**3.01E+13**	**fraction**
Calculated soil leachate concentration	Co	2.55E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**4.93E+13**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	9.66E+13	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**3.32E-14**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	2.88E+01	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.76E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

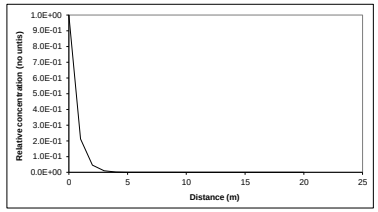
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.20E-03
1.0	2.13E-01	2.56E-04
2.0	4.52E-02	5.44E-05
3.0	9.62E-03	1.16E-05
4.0	2.05E-03	2.46E-06
5.0	4.35E-04	5.23E-07
6.0	9.25E-05	1.11E-07
7.0	1.96E-05	2.36E-08
8.0	4.17E-06	5.01E-09
9.0	8.84E-07	1.06E-09
10.0	1.87E-07	2.25E-10
11.0	3.96E-08	4.76E-11
12.0	8.39E-09	1.01E-11
13.0	1.77E-09	2.13E-12
14.0	3.75E-10	4.50E-13
15.0	7.92E-11	9.51E-14
16.0	1.67E-11	2.01E-14
17.0	3.53E-12	4.24E-15
18.0	7.45E-13	8.95E-16
19.0	1.57E-13	1.89E-16
20.0	3.32E-14	3.99E-17

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	TPH Aromatic C5-C7			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C5-C7**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.16E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.76E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**4.12E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.35E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C5-C7**		from Level 1
Target concentration	**C_T**	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.13E+02**		
Level 2 Remedial Target		**2.13E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		9.27E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C5-C7		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	2.13E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	7.30E+02	days	*Howard et al*
Calculated decay rate	λ	9.50E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.12E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	1.00E+01	fraction
Decay rate used	λ	9.50E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	3.91E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	2.57E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**3.89E+01**	**fraction**
Calculated soil leachate concentration	Co	2.30E-01	mg/l

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	6.76E+01	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	4.12E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

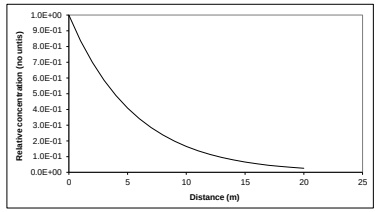
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.08E-03
1.0	8.36E-01	9.02E-04
2.0	6.99E-01	7.54E-04
3.0	5.84E-01	6.31E-04
4.0	4.89E-01	5.27E-04
5.0	4.08E-01	4.41E-04
6.0	3.41E-01	3.68E-04
7.0	2.85E-01	3.07E-04
8.0	2.38E-01	2.56E-04
9.0	1.98E-01	2.14E-04
10.0	1.65E-01	1.78E-04
11.0	1.37E-01	1.48E-04
12.0	1.14E-01	1.23E-04
13.0	9.48E-02	1.02E-04
14.0	7.87E-02	8.49E-05
15.0	6.54E-02	7.05E-05
16.0	5.43E-02	5.86E-05
17.0	4.50E-02	4.86E-05
18.0	3.74E-02	4.03E-05
19.0	3.10E-02	3.34E-05
20.0	2.57E-02	2.77E-05

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Remedial Targets

Level 3 Remedial Target		**8.29E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		3.61E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**2.57E-02**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**TPH Aromatic C8-C10**			
Target Concentration (C_T)	**0.01**	**mg/l**	**Origin of C_T:**	**EQS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C8-C10**		
Target concentration	**C_T**	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	2.53E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	1.58E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**9.65E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**9.68E-01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C8-C10**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.13E+02**		
Level 2 Remedial Target		**2.13E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.06E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C8-C10		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	2.13E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		29	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.28E+02	days	*Howard et al*
Calculated decay rate	λ	3.04E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.65E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	2.12E+02	fraction
Decay rate used	λ	1.43E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	1.84E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.99E-04	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**5.03E+03**	**fraction**
Calculated soil leachate concentration	Co	3.00E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**1.07E+04**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.04E+06	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**1.99E-04**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	1.58E+03	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.65E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

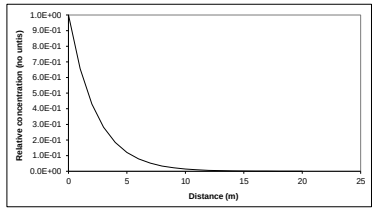
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.41E-03
1.0	6.56E-01	9.22E-04
2.0	4.30E-01	6.05E-04
3.0	2.82E-01	3.96E-04
4.0	1.85E-01	2.60E-04
5.0	1.21E-01	1.70E-04
6.0	7.93E-02	1.12E-04
7.0	5.19E-02	7.31E-05
8.0	3.40E-02	4.78E-05
9.0	2.22E-02	3.12E-05
10.0	1.45E-02	2.04E-05
11.0	9.46E-03	1.33E-05
12.0	6.17E-03	8.68E-06
13.0	4.02E-03	5.65E-06
14.0	2.62E-03	3.68E-06
15.0	1.71E-03	2.40E-06
16.0	1.11E-03	1.56E-06
17.0	7.22E-04	1.02E-06
18.0	4.70E-04	6.61E-07
19.0	3.06E-04	4.30E-07
20.0	1.99E-04	2.80E-07

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	TPH Aromatic C10-C12			
Target Concentration (C_T)	0.09	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C10-C12**		
Target concentration	**C_T**	**0.09**	**mg/l**	
Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	7.22E-02	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	2.51E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.53E+02**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.38E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.09	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C10-C12**		from Level 1
Target concentration	**C_T**	**0.09**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.15E+02**		
Level 2 Remedial Target		**1.93E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.96E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C10-C12		from Level 1
Target Concentration	C_T	0.09	mg/l	from Level 1
Dilution Factor	DF	2.15E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		20	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.58E+02	days	*Howard et al*
Calculated decay rate	λ	2.69E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.53E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	3.35E+02	fraction
Decay rate used	λ	8.01E-06	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	1.16E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	3.97E-04	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**2.52E+03**	**fraction**
Calculated soil leachate concentration	Co	1.31E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**4.87E+04**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		7.47E+06	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**3.97E-04**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	2.51E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.53E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

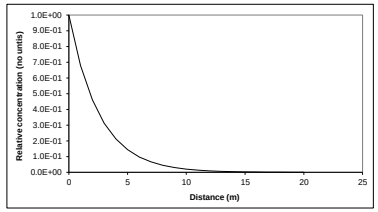
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	6.07E-04
1.0	6.79E-01	4.12E-04
2.0	4.61E-01	2.80E-04
3.0	3.13E-01	1.90E-04
4.0	2.12E-01	1.29E-04
5.0	1.44E-01	8.74E-05
6.0	9.76E-02	5.93E-05
7.0	6.61E-02	4.02E-05
8.0	4.48E-02	2.72E-05
9.0	3.03E-02	1.84E-05
10.0	2.05E-02	1.24E-05
11.0	1.38E-02	8.40E-06
12.0	9.34E-03	5.67E-06
13.0	6.30E-03	3.83E-06
14.0	4.25E-03	2.58E-06
15.0	2.86E-03	1.74E-06
16.0	1.93E-03	1.17E-06
17.0	1.30E-03	7.89E-07
18.0	8.75E-04	5.32E-07
19.0	5.89E-04	3.58E-07
20.0	3.97E-04	2.41E-07

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Zinc			
Target Concentration (C_T)	0.0109	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Zinc**		
Target concentration	**C_T**	**0.0109**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	3.80E+01	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**3.80E+01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.16E-01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0109	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Zinc**		from Level 1
Target concentration	**C_T**	**0.0109**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	3.30E-04	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**2.13E+02**		
Level 2 Remedial Target		**2.32E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		8.88E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Zinc		from Level 1
Target Concentration	C_T	0.0109	mg/l	from Level 1
Dilution Factor	DF	2.13E+02		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1000	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	3.32E-04	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.80E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	3.90E-03	m/d
Retardation factor	Rf	8.40E+01	fraction
Decay rate used	λ	8.25E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	3.32E-04	fraction
Rate of contaminant flow due to retardation	u	4.65E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	2.62E+01	mg/l

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 3.80E+01 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction

Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 3.80E+01 — l/kg

Define dispersivity (click brown cell and use pull down list)

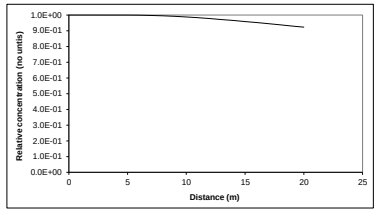
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.23E-01
1.0	1.00E+00	1.23E-01
2.0	1.00E+00	1.23E-01
3.0	1.00E+00	1.23E-01
4.0	1.00E+00	1.23E-01
5.0	1.00E+00	1.23E-01
6.0	9.99E-01	1.23E-01
7.0	9.97E-01	1.22E-01
8.0	9.95E-01	1.22E-01
9.0	9.92E-01	1.22E-01
10.0	9.88E-01	1.21E-01
11.0	9.83E-01	1.21E-01
12.0	9.78E-01	1.20E-01
13.0	9.72E-01	1.19E-01
14.0	9.65E-01	1.19E-01
15.0	9.59E-01	1.18E-01
16.0	9.52E-01	1.17E-01
17.0	9.45E-01	1.16E-01
18.0	9.38E-01	1.15E-01
19.0	9.30E-01	1.14E-01
20.0	9.23E-01	1.13E-01

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank		
Completed by:	Nicola Sellars		
Date:	########		
Version:	1		

Remedial Targets

Level 3 Remedial Target		**2.52E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		9.62E+01	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**9.23E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Source Area 2 – Infilled Clay Pit (Southern Sector)

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Benzene**			
Target Concentration (C_T)	**0.01**	**mg/l**	**Origin of C_T:**	**EQS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Benzene**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.16E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.76E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**4.12E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.35E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Benzene**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.68E+01**		
Level 2 Remedial Target		**7.68E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.34E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Benzene		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	7.68E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		2.3	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	7.30E+02	days	*Howard et al*
Calculated decay rate	λ	9.50E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.12E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	1.00E+01	fraction
Decay rate used	λ	9.50E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	1.97E-03	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	4.12E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**2.43E+00**	**fraction**
Calculated soil leachate concentration	Co	5.29E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**1.86E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		8.10E+00	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**4.12E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — 6.09E-02 — fraction

Organic carbon partition coefficient — Koc — 6.76E+01 — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 4.12E+00 — l/kg

Define dispersivity (click brown cell and use pull down list)

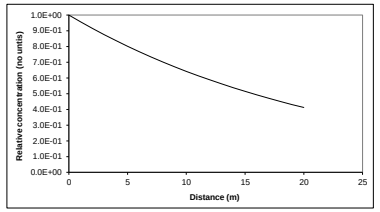
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	6.89E-03
1.0	9.57E-01	6.59E-03
2.0	9.15E-01	6.30E-03
3.0	8.76E-01	6.03E-03
4.0	8.38E-01	5.77E-03
5.0	8.01E-01	5.52E-03
6.0	7.67E-01	5.28E-03
7.0	7.33E-01	5.05E-03
8.0	7.02E-01	4.83E-03
9.0	6.71E-01	4.62E-03
10.0	6.42E-01	4.42E-03
11.0	6.14E-01	4.23E-03
12.0	5.88E-01	4.05E-03
13.0	5.62E-01	3.87E-03
14.0	5.38E-01	3.70E-03
15.0	5.15E-01	3.54E-03
16.0	4.92E-01	3.39E-03
17.0	4.71E-01	3.24E-03
18.0	4.51E-01	3.10E-03
19.0	4.31E-01	2.97E-03
20.0	4.12E-01	2.84E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	m-xylene			
Target Concentration (C_T)	0.5	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**m-xylene**		
Target concentration	C_T	**0.5**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.12E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	4.90E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**2.98E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.50E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.5	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**m-xylene**		from Level 1
Target concentration	C_T	**0.5**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.75E+01**		
Level 2 Remedial Target		**3.88E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.17E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		m-xylene		from Level 1
Target Concentration	C_T	0.5	mg/l	from Level 1
Dilution Factor	DF	7.75E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1.7	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.12E+02	days	*Howard et al*
Calculated decay rate	λ	6.19E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.98E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	6.62E+01	fraction
Decay rate used	λ	9.35E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	2.97E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.26E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**7.94E+01**	**fraction**
Calculated soil leachate concentration	Co	5.66E-02	mg/l

Remedial Targets

Level 3 Remedial Target	**3.08E+03**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	9.25E+04	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**1.26E-02**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	4.90E+02	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.98E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

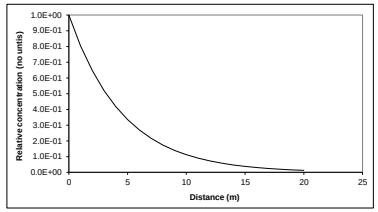
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	7.29E-04
1.0	8.04E-01	5.86E-04
2.0	6.46E-01	4.71E-04
3.0	5.19E-01	3.78E-04
4.0	4.17E-01	3.04E-04
5.0	3.35E-01	2.44E-04
6.0	2.69E-01	1.96E-04
7.0	2.16E-01	1.58E-04
8.0	1.74E-01	1.27E-04
9.0	1.40E-01	1.02E-04
10.0	1.12E-01	8.19E-05
11.0	9.02E-02	6.58E-05
12.0	7.25E-02	5.29E-05
13.0	5.82E-02	4.25E-05
14.0	4.68E-02	3.41E-05
15.0	3.76E-02	2.74E-05
16.0	3.02E-02	2.20E-05
17.0	2.43E-02	1.77E-05
18.0	1.95E-02	1.42E-05
19.0	1.57E-02	1.14E-05
20.0	1.26E-02	9.19E-06

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	o-xylene			
Target Concentration (C_T)	0.5	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**o-xylene**		
Target concentration	C_T	**0.5**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	9.20E-02	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	4.27E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**2.60E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.31E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.5	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**o-xylene**		from Level 1
Target concentration	C_T	**0.5**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.75E+01**		
Level 2 Remedial Target		**3.88E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.02E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		o-xylene		from Level 1
Target Concentration	C_T	0.5	mg/l	from Level 1
Dilution Factor	DF	7.75E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.97	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	3.65E+02	days	*Howard et al*
Calculated decay rate	λ	1.90E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.60E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	5.78E+01	fraction
Decay rate used	λ	3.29E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	3.41E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.91E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**5.23E+00**	**fraction**
Calculated soil leachate concentration	Co	3.70E-02	mg/l

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — 6.09E-02 — fraction

Organic carbon partition coefficient — Koc — 4.27E+02 — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 2.60E+01 — l/kg

Define dispersivity (click brown cell and use pull down list)

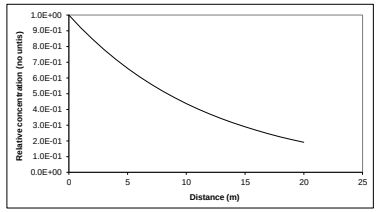
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	4.77E-04
1.0	9.21E-01	4.40E-04
2.0	8.47E-01	4.05E-04
3.0	7.80E-01	3.72E-04
4.0	7.18E-01	3.43E-04
5.0	6.61E-01	3.16E-04
6.0	6.09E-01	2.91E-04
7.0	5.60E-01	2.67E-04
8.0	5.16E-01	2.46E-04
9.0	4.75E-01	2.27E-04
10.0	4.37E-01	2.09E-04
11.0	4.02E-01	1.92E-04
12.0	3.70E-01	1.77E-04
13.0	3.41E-01	1.63E-04
14.0	3.14E-01	1.50E-04
15.0	2.89E-01	1.38E-04
16.0	2.66E-01	1.27E-04
17.0	2.45E-01	1.17E-04
18.0	2.25E-01	1.08E-04
19.0	2.08E-01	9.91E-05
20.0	1.91E-01	9.12E-05

Remedial Targets

Level 3 Remedial Target		**2.03E+02**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		5.32E+03	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.91E-01**	**fraction**	Ogata Banks

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	p-xylene			
Target Concentration (C_T)	0.5	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**p-xylene**		
Target concentration	C_T	**0.5**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.07E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	4.47E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**2.72E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.37E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.5	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**p-xylene**		from Level 1
Target concentration	**C_T**	**0.5**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.75E+01**		
Level 2 Remedial Target		**3.88E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.06E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		p-xylene		from Level 1
Target Concentration	C_T	0.5	mg/l	from Level 1
Dilution Factor	DF	7.75E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1.7	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.12E+02	days	*Howard et al*
Calculated decay rate	λ	6.19E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.72E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	6.04E+01	fraction
Decay rate used	λ	1.02E-04	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	3.26E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.26E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**7.94E+01**	**fraction**
Calculated soil leachate concentration	Co	6.20E-02	mg/l

Remedial Targets

Level 3 Remedial Target	**3.08E+03**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	8.44E+04	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**1.26E-02**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	4.47E+02	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.72E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

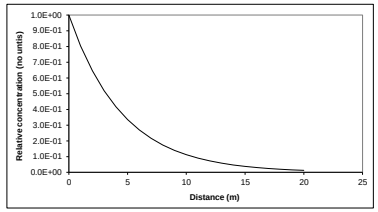
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	7.99E-04
1.0	8.04E-01	6.42E-04
2.0	6.46E-01	5.16E-04
3.0	5.19E-01	4.15E-04
4.0	4.17E-01	3.33E-04
5.0	3.35E-01	2.68E-04
6.0	2.69E-01	2.15E-04
7.0	2.16E-01	1.73E-04
8.0	1.74E-01	1.39E-04
9.0	1.40E-01	1.12E-04
10.0	1.12E-01	8.97E-05
11.0	9.02E-02	7.21E-05
12.0	7.25E-02	5.79E-05
13.0	5.82E-02	4.66E-05
14.0	4.68E-02	3.74E-05
15.0	3.76E-02	3.01E-05
16.0	3.02E-02	2.42E-05
17.0	2.43E-02	1.94E-05
18.0	1.95E-02	1.56E-05
19.0	1.57E-02	1.25E-05
20.0	1.26E-02	1.01E-05

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Arsenic**			
Target Concentration (C_T)	**0.01**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Arsenic**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.00E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Arsenic**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.68E+01**		
Level 2 Remedial Target		**7.68E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.84E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Arsenic		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	7.68E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		150	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	1.80E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	3.00E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**7.68E-01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		3.84E+02	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	5.00E+02	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{w,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction

Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

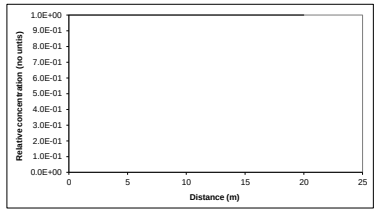
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	3.91E-03
1.0	1.00E+00	3.91E-03
2.0	1.00E+00	3.91E-03
3.0	1.00E+00	3.91E-03
4.0	1.00E+00	3.91E-03
5.0	1.00E+00	3.91E-03
6.0	1.00E+00	3.91E-03
7.0	1.00E+00	3.91E-03
8.0	1.00E+00	3.91E-03
9.0	1.00E+00	3.91E-03
10.0	1.00E+00	3.91E-03
11.0	1.00E+00	3.91E-03
12.0	1.00E+00	3.91E-03
13.0	1.00E+00	3.91E-03
14.0	1.00E+00	3.91E-03
15.0	1.00E+00	3.91E-03
16.0	1.00E+00	3.91E-03
17.0	1.00E+00	3.91E-03
18.0	1.00E+00	3.91E-03
19.0	1.00E+00	3.91E-03
20.0	1.00E+00	3.91E-03

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Chromium III			
Target Concentration (C_T)	0.05	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Chromium III**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	4.80E+03	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**4.80E+03**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.40E+02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Chromium III**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.74E+01**		
Level 2 Remedial Target		**3.87E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.86E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Chromium III		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	7.74E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		46	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.80E+03	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	1.05E+04	fraction
Decay rate used	λ	6.61E-105	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	1.88E-06	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	9.58E-03	mg/l

Remedial Targets

Level 3 Remedial Target		**3.87E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.86E+04	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	4.80E+03	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction

Soil water partition coefficient	Kd	4.80E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

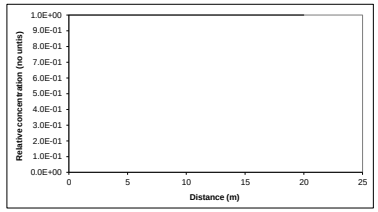
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.24E-04
1.0	1.00E+00	1.24E-04
2.0	1.00E+00	1.24E-04
3.0	1.00E+00	1.24E-04
4.0	1.00E+00	1.24E-04
5.0	1.00E+00	1.24E-04
6.0	1.00E+00	1.24E-04
7.0	1.00E+00	1.24E-04
8.0	1.00E+00	1.24E-04
9.0	1.00E+00	1.24E-04
10.0	1.00E+00	1.24E-04
11.0	1.00E+00	1.24E-04
12.0	1.00E+00	1.24E-04
13.0	1.00E+00	1.24E-04
14.0	1.00E+00	1.24E-04
15.0	1.00E+00	1.24E-04
16.0	1.00E+00	1.24E-04
17.0	1.00E+00	1.24E-04
18.0	1.00E+00	1.24E-04
19.0	1.00E+00	1.24E-04
20.0	1.00E+00	1.24E-04

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Chromium IV			
Target Concentration (C_T)	0.0034	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Chromium IV**		
Target concentration	C_T	**0.0034**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.80E+01	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**1.80E+01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**6.19E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0034	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Chromium IV**		from Level 1
Target concentration	C_T	**0.0034**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.53E+01**		
Level 2 Remedial Target		**2.56E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		4.66E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Chromium IV		from Level 1
Target Concentration	C_T	0.0034	mg/l	from Level 1
Dilution Factor	DF	7.53E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.5	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.80E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	4.03E+01	fraction
Decay rate used	λ	1.72E-102	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	4.88E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	2.75E-02	mg/l

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 1.80E+01 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction

Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{w,i}$ — l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient	Kd	1.80E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

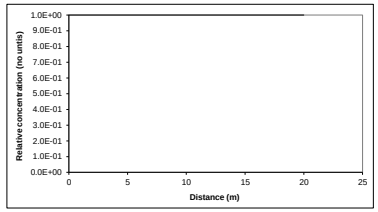
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	3.65E-04
1.0	1.00E+00	3.65E-04
2.0	1.00E+00	3.65E-04
3.0	1.00E+00	3.65E-04
4.0	1.00E+00	3.65E-04
5.0	1.00E+00	3.65E-04
6.0	1.00E+00	3.65E-04
7.0	1.00E+00	3.65E-04
8.0	1.00E+00	3.65E-04
9.0	1.00E+00	3.65E-04
10.0	1.00E+00	3.65E-04
11.0	1.00E+00	3.65E-04
12.0	1.00E+00	3.65E-04
13.0	1.00E+00	3.65E-04
14.0	1.00E+00	3.65E-04
15.0	1.00E+00	3.65E-04
16.0	1.00E+00	3.65E-04
17.0	1.00E+00	3.65E-04
18.0	1.00E+00	3.65E-04
19.0	1.00E+00	3.65E-04
20.0	1.00E+00	3.65E-04

Remedial Targets

Level 3 Remedial Target		**2.56E-01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		4.66E+00	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Copper			
Target Concentration (C_T)	2	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Copper**		
Target concentration	C_T	**2**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**1.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.00E+02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	2	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Copper**		from Level 1
Target concentration	C_T	**2**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.75E+01**		
Level 2 Remedial Target		**1.55E+02**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.55E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Copper		from Level 1
Target Concentration	C_T	2	mg/l	from Level 1
Dilution Factor	DF	7.75E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		2600	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	2.20E+02	fraction
Decay rate used	λ	3.16E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	8.97E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	2.59E+01	mg/l

Remedial Targets

Level 3 Remedial Target	**1.55E+02**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.55E+04	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0 **1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	1.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{w,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

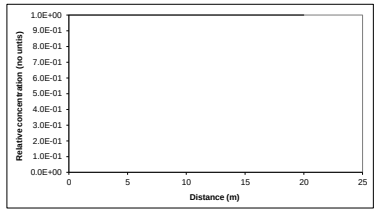
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	3.35E-01
1.0	1.00E+00	3.35E-01
2.0	1.00E+00	3.35E-01
3.0	1.00E+00	3.35E-01
4.0	1.00E+00	3.35E-01
5.0	1.00E+00	3.35E-01
6.0	1.00E+00	3.35E-01
7.0	1.00E+00	3.35E-01
8.0	1.00E+00	3.35E-01
9.0	1.00E+00	3.35E-01
10.0	1.00E+00	3.35E-01
11.0	1.00E+00	3.35E-01
12.0	1.00E+00	3.35E-01
13.0	1.00E+00	3.35E-01
14.0	1.00E+00	3.35E-01
15.0	1.00E+00	3.35E-01
16.0	1.00E+00	3.35E-01
17.0	1.00E+00	3.35E-01
18.0	1.00E+00	3.35E-01
19.0	1.00E+00	3.35E-01
20.0	1.00E+00	3.35E-01

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Cyanide			
Target Concentration (C_T)	0.05	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Cyanide**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**1.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.01E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Cyanide**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.74E+01**		
Level 2 Remedial Target		**3.87E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.88E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Cyanide		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	7.74E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		73	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	2.20E+02	fraction
Decay rate used	λ	3.16E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	8.97E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	7.29E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**3.87E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	3.88E+02	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0 **1.00E+00**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 1.00E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction
Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg
Sorption coefficient for ionised species — $K_{ow,i}$ — l/kg
pH value — pH
Acid dissociation constant — pKa
Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 1.00E+02 l/kg

Define dispersivity (click brown cell and use pull down list)

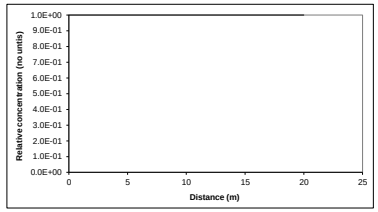
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	9.41E-03
1.0	1.00E+00	9.41E-03
2.0	1.00E+00	9.41E-03
3.0	1.00E+00	9.41E-03
4.0	1.00E+00	9.41E-03
5.0	1.00E+00	9.41E-03
6.0	1.00E+00	9.41E-03
7.0	1.00E+00	9.41E-03
8.0	1.00E+00	9.41E-03
9.0	1.00E+00	9.41E-03
10.0	1.00E+00	9.41E-03
11.0	1.00E+00	9.41E-03
12.0	1.00E+00	9.41E-03
13.0	1.00E+00	9.41E-03
14.0	1.00E+00	9.41E-03
15.0	1.00E+00	9.41E-03
16.0	1.00E+00	9.41E-03
17.0	1.00E+00	9.41E-03
18.0	1.00E+00	9.41E-03
19.0	1.00E+00	9.41E-03
20.0	1.00E+00	9.41E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Lead			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Lead**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.00E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Lead**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.68E+01**		
Level 2 Remedial Target		**7.68E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.84E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Lead		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	7.68E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1100	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	1.80E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	2.20E+00	mg/l

Remedial Targets

Level 3 Remedial Target		**7.68E-01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		3.84E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{w,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction

Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

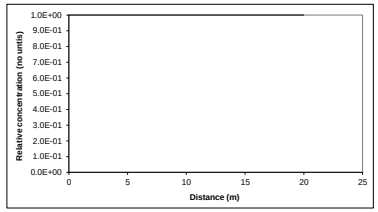
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.86E-02
1.0	1.00E+00	2.86E-02
2.0	1.00E+00	2.86E-02
3.0	1.00E+00	2.86E-02
4.0	1.00E+00	2.86E-02
5.0	1.00E+00	2.86E-02
6.0	1.00E+00	2.86E-02
7.0	1.00E+00	2.86E-02
8.0	1.00E+00	2.86E-02
9.0	1.00E+00	2.86E-02
10.0	1.00E+00	2.86E-02
11.0	1.00E+00	2.86E-02
12.0	1.00E+00	2.86E-02
13.0	1.00E+00	2.86E-02
14.0	1.00E+00	2.86E-02
15.0	1.00E+00	2.86E-02
16.0	1.00E+00	2.86E-02
17.0	1.00E+00	2.86E-02
18.0	1.00E+00	2.86E-02
19.0	1.00E+00	2.86E-02
20.0	1.00E+00	2.86E-02

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Manganese			
Target Concentration (C_T)	0.05	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Manganese**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*Estimate*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.50E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Manganese**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.74E+01**		
Level 2 Remedial Target		**3.87E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.94E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	7.74E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	1.80E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	2.00E-03	mg/l

Remedial Targets

Level 3 Remedial Target		**3.87E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.94E+03	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

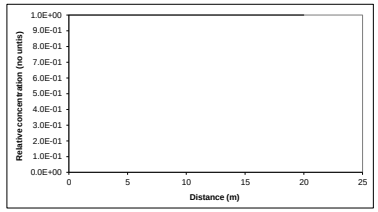
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.58E-05
1.0	1.00E+00	2.58E-05
2.0	1.00E+00	2.58E-05
3.0	1.00E+00	2.58E-05
4.0	1.00E+00	2.58E-05
5.0	1.00E+00	2.58E-05
6.0	1.00E+00	2.58E-05
7.0	1.00E+00	2.58E-05
8.0	1.00E+00	2.58E-05
9.0	1.00E+00	2.58E-05
10.0	1.00E+00	2.58E-05
11.0	1.00E+00	2.58E-05
12.0	1.00E+00	2.58E-05
13.0	1.00E+00	2.58E-05
14.0	1.00E+00	2.58E-05
15.0	1.00E+00	2.58E-05
16.0	1.00E+00	2.58E-05
17.0	1.00E+00	2.58E-05
18.0	1.00E+00	2.58E-05
19.0	1.00E+00	2.58E-05
20.0	1.00E+00	2.58E-05

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Naphthalene			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Naphthalene**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	6.62E-03	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.46E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.93E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**3.95E-01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Naphthalene**		from Level 1
Target concentration	**C_T**	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.68E+01**		
Level 2 Remedial Target		**7.68E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.03E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Naphthalene		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	7.68E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		19	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.58E+02	days	*Howard et al*
Calculated decay rate	λ	2.69E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.93E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	8.69E+01	fraction
Decay rate used	λ	3.09E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	2.27E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.07E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**9.31E+00**	**fraction**
Calculated soil leachate concentration	Co	4.81E-01	mg/l

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — [redacted] l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — 6.09E-02 fraction

Organic carbon partition coefficient — Koc — 6.46E+02 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — [redacted] l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — [redacted] l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — [redacted] fraction

Soil water partition coefficient — Kd — 3.93E+01 l/kg

Define dispersivity (click brown cell and use pull down list)

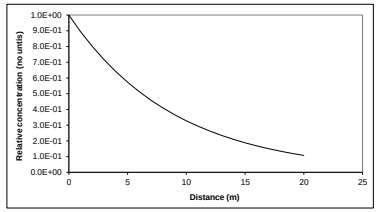
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	6.26E-03
1.0	8.94E-01	5.60E-03
2.0	8.00E-01	5.01E-03
3.0	7.16E-01	4.48E-03
4.0	6.40E-01	4.01E-03
5.0	5.72E-01	3.58E-03
6.0	5.12E-01	3.21E-03
7.0	4.58E-01	2.87E-03
8.0	4.10E-01	2.56E-03
9.0	3.66E-01	2.29E-03
10.0	3.28E-01	2.05E-03
11.0	2.93E-01	1.84E-03
12.0	2.62E-01	1.64E-03
13.0	2.35E-01	1.47E-03
14.0	2.10E-01	1.31E-03
15.0	1.88E-01	1.17E-03
16.0	1.68E-01	1.05E-03
17.0	1.50E-01	9.40E-04
18.0	1.34E-01	8.41E-04
19.0	1.20E-01	7.52E-04
20.0	1.07E-01	6.72E-04

Site being assessed:	Ryebank			
Completed by:	Nicola Sellars			
Date:	########			
Version:	1			

Remedial Targets

Level 3 Remedial Target		**7.15E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		2.83E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.07E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Nickel			
Target Concentration (C_T)	0.02	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Nickel**		
Target concentration	C_T	**0.02**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.00E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.02	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Nickel**		from Level 1
Target concentration	C_T	**0.02**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.72E+01**		
Level 2 Remedial Target		**1.54E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		7.72E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Nickel		from Level 1
Target Concentration	C_T	0.02	mg/l	from Level 1
Dilution Factor	DF	7.72E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		110	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	1.80E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	2.20E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**1.54E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	7.72E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	5.00E+02	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{w,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

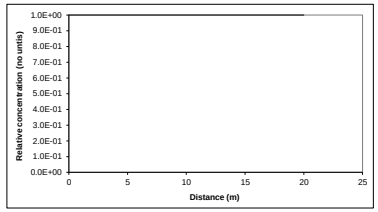
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.85E-03
1.0	1.00E+00	2.85E-03
2.0	1.00E+00	2.85E-03
3.0	1.00E+00	2.85E-03
4.0	1.00E+00	2.85E-03
5.0	1.00E+00	2.85E-03
6.0	1.00E+00	2.85E-03
7.0	1.00E+00	2.85E-03
8.0	1.00E+00	2.85E-03
9.0	1.00E+00	2.85E-03
10.0	1.00E+00	2.85E-03
11.0	1.00E+00	2.85E-03
12.0	1.00E+00	2.85E-03
13.0	1.00E+00	2.85E-03
14.0	1.00E+00	2.85E-03
15.0	1.00E+00	2.85E-03
16.0	1.00E+00	2.85E-03
17.0	1.00E+00	2.85E-03
18.0	1.00E+00	2.85E-03
19.0	1.00E+00	2.85E-03
20.0	1.00E+00	2.85E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	TPH Aromatic C5-C7			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C5-C7**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.16E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.76E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**4.12E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.35E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C5-C7**		from Level 1
Target concentration	**C_T**	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.68E+01**		
Level 2 Remedial Target		**7.68E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.34E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C5-C7		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	7.68E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		2.3	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	7.30E+02	days	*Howard et al*
Calculated decay rate	λ	9.50E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.12E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	1.00E+01	fraction
Decay rate used	λ	9.50E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	1.97E-03	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	4.12E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**2.43E+00**	**fraction**
Calculated soil leachate concentration	Co	5.29E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**1.86E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	8.10E+00	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**4.12E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	6.76E+01	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	4.12E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

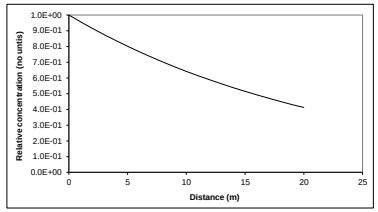
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	6.89E-03
1.0	9.57E-01	6.59E-03
2.0	9.15E-01	6.30E-03
3.0	8.76E-01	6.03E-03
4.0	8.38E-01	5.77E-03
5.0	8.01E-01	5.52E-03
6.0	7.67E-01	5.28E-03
7.0	7.33E-01	5.05E-03
8.0	7.02E-01	4.83E-03
9.0	6.71E-01	4.62E-03
10.0	6.42E-01	4.42E-03
11.0	6.14E-01	4.23E-03
12.0	5.88E-01	4.05E-03
13.0	5.62E-01	3.87E-03
14.0	5.38E-01	3.70E-03
15.0	5.15E-01	3.54E-03
16.0	4.92E-01	3.39E-03
17.0	4.71E-01	3.24E-03
18.0	4.51E-01	3.10E-03
19.0	4.31E-01	2.97E-03
20.0	4.12E-01	2.84E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	TPH Aromatic C8-C10			
Target Concentration (C_T)	0.3	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C8-C10**		
Target concentration	C_T	**0.3**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	2.53E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	1.58E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**9.65E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.90E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.3	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C8-C10**		from Level 1
Target concentration	**C_T**	**0.3**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.75E+01**		
Level 2 Remedial Target		**2.33E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.25E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C8-C10		from Level 1
Target Concentration	C_T	0.3	mg/l	from Level 1
Dilution Factor	DF	7.75E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		53	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.28E+02	days	*Howard et al*
Calculated decay rate	λ	3.04E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.65E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	2.12E+02	fraction
Decay rate used	λ	1.43E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	9.29E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	8.41E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.19E+01**	**fraction**
Calculated soil leachate concentration	Co	5.48E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**2.76E+02**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		2.68E+04	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**8.41E-02**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — 6.09E-02 — fraction

Organic carbon partition coefficient — Koc — 1.58E+03 — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 9.65E+01 — l/kg

Define dispersivity (click brown cell and use pull down list)

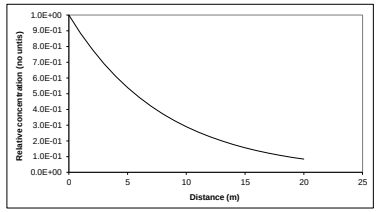
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	7.06E-03
1.0	8.84E-01	6.24E-03
2.0	7.81E-01	5.51E-03
3.0	6.90E-01	4.87E-03
4.0	6.10E-01	4.31E-03
5.0	5.39E-01	3.80E-03
6.0	4.76E-01	3.36E-03
7.0	4.20E-01	2.97E-03
8.0	3.71E-01	2.62E-03
9.0	3.28E-01	2.32E-03
10.0	2.90E-01	2.05E-03
11.0	2.56E-01	1.81E-03
12.0	2.26E-01	1.60E-03
13.0	2.00E-01	1.41E-03
14.0	1.77E-01	1.25E-03
15.0	1.56E-01	1.10E-03
16.0	1.38E-01	9.75E-04
17.0	1.22E-01	8.61E-04
18.0	1.08E-01	7.61E-04
19.0	9.52E-02	6.72E-04
20.0	8.41E-02	5.94E-04

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**TPH Aromatic C10-C12**			
Target Concentration (C_T)	**0.09**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C10-C12**		
Target concentration	**C_T**	**0.09**	**mg/l**	
Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	7.22E-02	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	2.51E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.53E+02**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.38E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.09	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C10-C12**		from Level 1
Target concentration	**C_T**	**0.09**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.75E+01**		
Level 2 Remedial Target		**6.97E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.07E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C10-C12		from Level 1
Target Concentration	C_T	0.09	mg/l	from Level 1
Dilution Factor	DF	7.75E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		40	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.58E+02	days	*Howard et al*
Calculated decay rate	λ	2.69E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.53E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	3.35E+02	fraction
Decay rate used	λ	8.01E-06	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	5.87E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.07E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**9.31E+00**	**fraction**
Calculated soil leachate concentration	Co	2.61E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**6.49E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	9.95E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**1.07E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	2.51E+03	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.53E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

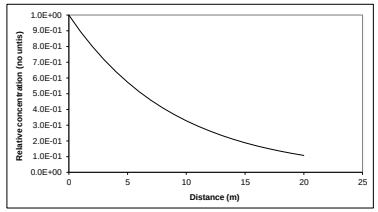
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	3.37E-03
1.0	8.94E-01	3.01E-03
2.0	8.00E-01	2.70E-03
3.0	7.16E-01	2.41E-03
4.0	6.40E-01	2.16E-03
5.0	5.72E-01	1.93E-03
6.0	5.12E-01	1.73E-03
7.0	4.58E-01	1.54E-03
8.0	4.10E-01	1.38E-03
9.0	3.66E-01	1.23E-03
10.0	3.28E-01	1.10E-03
11.0	2.93E-01	9.88E-04
12.0	2.62E-01	8.84E-04
13.0	2.34E-01	7.90E-04
14.0	2.10E-01	7.07E-04
15.0	1.88E-01	6.32E-04
16.0	1.68E-01	5.66E-04
17.0	1.50E-01	5.06E-04
18.0	1.34E-01	4.52E-04
19.0	1.20E-01	4.05E-04
20.0	1.07E-01	3.62E-04

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**TPH Aromatic C12-C16**			
Target Concentration (C_T)	**0.09**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C12-C16**		
Target concentration	**C_T**	**0.09**	**mg/l**	
Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.26E-03	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	5.01E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.05E+02**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.75E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.09	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C12-C16**		from Level 1
Target concentration	**C_T**	**0.09**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.75E+01**		
Level 2 Remedial Target		**6.97E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.13E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C12-C16		from Level 1
Target Concentration	C_T	0.09	mg/l	from Level 1
Dilution Factor	DF	7.75E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		200	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.84E+03	days	*Howard et al*
Calculated decay rate	λ	3.77E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.05E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	6.68E+02	fraction
Decay rate used	λ	5.64E-07	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	2.95E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.91E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.45E+00**	**fraction**
Calculated soil leachate concentration	Co	6.55E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**1.01E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		3.08E+03	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**6.91E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	5.01E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.05E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

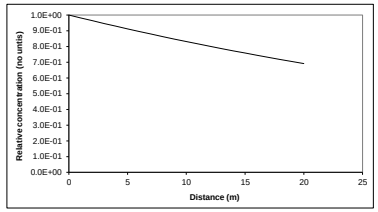
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	8.45E-03
1.0	9.82E-01	8.30E-03
2.0	9.64E-01	8.15E-03
3.0	9.46E-01	8.00E-03
4.0	9.29E-01	7.85E-03
5.0	9.12E-01	7.71E-03
6.0	8.95E-01	7.57E-03
7.0	8.79E-01	7.43E-03
8.0	8.63E-01	7.29E-03
9.0	8.47E-01	7.16E-03
10.0	8.31E-01	7.03E-03
11.0	8.16E-01	6.90E-03
12.0	8.01E-01	6.77E-03
13.0	7.87E-01	6.65E-03
14.0	7.72E-01	6.53E-03
15.0	7.58E-01	6.41E-03
16.0	7.44E-01	6.29E-03
17.0	7.31E-01	6.18E-03
18.0	7.17E-01	6.06E-03
19.0	7.04E-01	5.95E-03
20.0	6.91E-01	5.84E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Trichloromethane			
Target Concentration (C_T)	0.0025	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Trichloromethane**		
Target concentration	C_T	**0.0025**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	7.65E-02	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	5.01E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.05E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**8.19E-03**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0025	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Trichloromethane**		from Level 1
Target concentration	C_T	**0.0025**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.45E+01**		
Level 2 Remedial Target		**1.86E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		6.10E-01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Trichloromethane		from Level 1
Target Concentration	C_T	0.0025	mg/l	from Level 1
Dilution Factor	DF	7.45E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.001	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.80E+01	days	*Howard et al*
Calculated decay rate	λ	2.48E-02	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.05E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	7.67E+00	fraction
Decay rate used	λ	3.23E-03	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	2.57E-03	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	8.95E-06	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.12E+05**	**fraction**
Calculated soil leachate concentration	Co	3.05E-04	mg/l

Remedial Targets

Level 3 Remedial Target	**2.08E+04**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	6.81E+04	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**8.95E-06**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	5.01E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.05E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

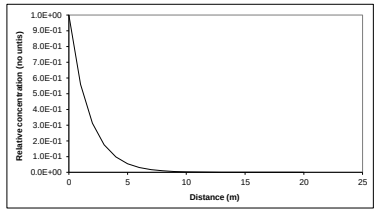
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	4.10E-06
1.0	5.59E-01	2.29E-06
2.0	3.13E-01	1.28E-06
3.0	1.75E-01	7.17E-07
4.0	9.78E-02	4.01E-07
5.0	5.47E-02	2.24E-07
6.0	3.06E-02	1.25E-07
7.0	1.71E-02	7.01E-08
8.0	9.57E-03	3.92E-08
9.0	5.35E-03	2.19E-08
10.0	2.99E-03	1.23E-08
11.0	1.67E-03	6.86E-09
12.0	9.36E-04	3.84E-09
13.0	5.23E-04	2.14E-09
14.0	2.93E-04	1.20E-09
15.0	1.64E-04	6.71E-10
16.0	9.15E-05	3.75E-10
17.0	5.12E-05	2.10E-10
18.0	2.86E-05	1.17E-10
19.0	1.60E-05	6.56E-11
20.0	8.95E-06	3.67E-11

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Zinc			
Target Concentration (C_T)	0.0109	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Zinc**		
Target concentration	C_T	**0.0109**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	3.80E+01	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**3.80E+01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.16E-01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0109	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Zinc**		from Level 1
Target concentration	**C_T**	**0.0109**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	9.80E+03	m^2	**70 m x 140 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.40E+02	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	7.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.50E+01	m		

Calculated Parameters

Dilution Factor	**DF**	**7.68E+01**		
Level 2 Remedial Target		**8.38E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.20E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Zinc		from Level 1
Target Concentration	C_T	0.0109	mg/l	from Level 1
Dilution Factor	DF	7.68E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		2500	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	7.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.80E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	8.40E+01	fraction
Decay rate used	λ	8.25E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	2.34E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.00E+00	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.00E+00**	**fraction**
Calculated soil leachate concentration	Co	6.54E+01	mg/l

Remedial Targets

Level 3 Remedial Target		**8.38E-01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		3.20E+01	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**1.00E+00**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	3.80E+01	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{w,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.80E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

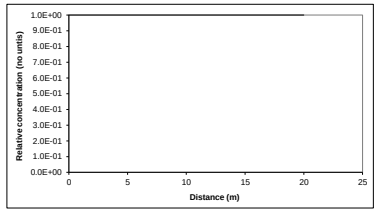
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	8.52E-01
1.0	1.00E+00	8.52E-01
2.0	1.00E+00	8.52E-01
3.0	1.00E+00	8.52E-01
4.0	1.00E+00	8.52E-01
5.0	1.00E+00	8.52E-01
6.0	1.00E+00	8.52E-01
7.0	1.00E+00	8.52E-01
8.0	1.00E+00	8.52E-01
9.0	1.00E+00	8.52E-01
10.0	1.00E+00	8.52E-01
11.0	1.00E+00	8.52E-01
12.0	1.00E+00	8.52E-01
13.0	1.00E+00	8.52E-01
14.0	1.00E+00	8.52E-01
15.0	1.00E+00	8.52E-01
16.0	1.00E+00	8.52E-01
17.0	1.00E+00	8.52E-01
18.0	1.00E+00	8.52E-01
19.0	1.00E+00	8.52E-01
20.0	1.00E+00	8.52E-01

Source Area 2 – (10 m x 10 m grid)

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Benzene**			
Target Concentration (C_T)	**0.01**	**mg/l**	**Origin of C_T:**	**EQS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Benzene**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.16E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.76E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**4.12E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.35E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Benzene**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Calculate**			
Enter mixing zone thickness	Mz		m		
Calculated mixing zone thickness	Mz	1.07E+00	m		

Calculated Parameters

Dilution Factor	**DF**	**7.68E+01**		
Level 2 Remedial Target		**7.68E-01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.34E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Benzene		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	7.68E+01		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		2.3	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	7.30E+02	days	*Howard et al*
Calculated decay rate	λ	9.50E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.07E+00	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.67E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.12E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.97E-02	m/d
Retardation factor	Rf	1.00E+01	fraction
Decay rate used	λ	9.50E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.67E-03	fraction
Rate of contaminant flow due to retardation	u	1.97E-03	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	2.93E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**3.42E+00**	**fraction**
Calculated soil leachate concentration	Co	5.29E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**2.62E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		1.14E+01	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**2.93E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — 6.09E-02 — fraction

Organic carbon partition coefficient — Koc — 6.76E+01 — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 4.12E+00 — l/kg

Define dispersivity (click brown cell and use pull down list)

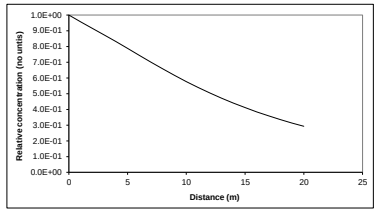
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	6.89E-03
1.0	9.57E-01	6.59E-03
2.0	9.15E-01	6.30E-03
3.0	8.74E-01	6.02E-03
4.0	8.31E-01	5.72E-03
5.0	7.88E-01	5.42E-03
6.0	7.44E-01	5.12E-03
7.0	7.00E-01	4.82E-03
8.0	6.57E-01	4.53E-03
9.0	6.16E-01	4.24E-03
10.0	5.77E-01	3.97E-03
11.0	5.40E-01	3.72E-03
12.0	5.05E-01	3.47E-03
13.0	4.71E-01	3.25E-03
14.0	4.40E-01	3.03E-03
15.0	4.11E-01	2.83E-03
16.0	3.84E-01	2.65E-03
17.0	3.59E-01	2.47E-03
18.0	3.35E-01	2.31E-03
19.0	3.13E-01	2.16E-03
20.0	2.93E-01	2.02E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	m-xylene			
Target Concentration (C_T)	0.5	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**m-xylene**		
Target concentration	C_T	**0.5**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.12E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	4.90E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**2.98E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.50E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.5	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**m-xylene**		from Level 1
Target concentration	**C_T**	**0.5**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**5.36E+02**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.61E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		m-xylene		from Level 1
Target Concentration	C_T	0.5	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1.7	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.12E+02	days	*Howard et al*
Calculated decay rate	λ	6.19E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.98E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	6.62E+01	fraction
Decay rate used	λ	9.35E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	2.94E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.12E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**8.95E+01**	**fraction**
Calculated soil leachate concentration	Co	5.66E-02	mg/l

Remedial Targets

Level 3 Remedial Target	**4.80E+04**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.44E+06	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0 **1.12E-02**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	4.90E+02	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.98E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

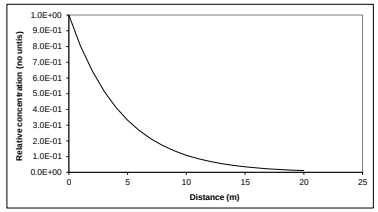
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	5.28E-05
1.0	8.02E-01	4.23E-05
2.0	6.43E-01	3.39E-05
3.0	5.16E-01	2.72E-05
4.0	4.14E-01	2.18E-05
5.0	3.32E-01	1.75E-05
6.0	2.66E-01	1.40E-05
7.0	2.13E-01	1.12E-05
8.0	1.70E-01	8.98E-06
9.0	1.36E-01	7.18E-06
10.0	1.09E-01	5.73E-06
11.0	8.67E-02	4.58E-06
12.0	6.92E-02	3.65E-06
13.0	5.51E-02	2.91E-06
14.0	4.39E-02	2.32E-06
15.0	3.50E-02	1.85E-06
16.0	2.78E-02	1.47E-06
17.0	2.22E-02	1.17E-06
18.0	1.76E-02	9.31E-07
19.0	1.40E-02	7.41E-07
20.0	1.12E-02	5.89E-07

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	o-xylene			
Target Concentration (C_T)	0.5	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**o-xylene**		
Target concentration	C_T	**0.5**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	9.20E-02	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	4.27E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**2.60E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.31E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.5	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**o-xylene**		from Level 1
Target concentration	C_T	**0.5**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**5.36E+02**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.40E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		o-xylene		from Level 1
Target Concentration	C_T	0.5	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.97	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	3.65E+02	days	*Howard et al*
Calculated decay rate	λ	1.90E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.60E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	5.78E+01	fraction
Decay rate used	λ	3.29E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	3.37E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.73E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**5.77E+00**	**fraction**
Calculated soil leachate concentration	Co	3.70E-02	mg/l

Remedial Targets

Level 3 Remedial Target	**3.09E+03**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	8.10E+04	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**1.73E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	4.27E+02	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.60E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

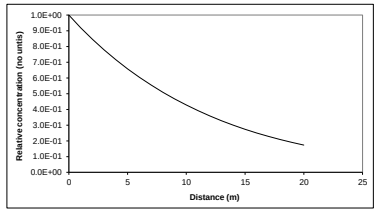
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	3.45E-05
1.0	9.20E-01	3.18E-05
2.0	8.46E-01	2.92E-05
3.0	7.78E-01	2.69E-05
4.0	7.16E-01	2.47E-05
5.0	6.58E-01	2.27E-05
6.0	6.05E-01	2.09E-05
7.0	5.55E-01	1.92E-05
8.0	5.10E-01	1.76E-05
9.0	4.67E-01	1.61E-05
10.0	4.28E-01	1.48E-05
11.0	3.92E-01	1.35E-05
12.0	3.58E-01	1.24E-05
13.0	3.28E-01	1.13E-05
14.0	2.99E-01	1.03E-05
15.0	2.73E-01	9.45E-06
16.0	2.50E-01	8.62E-06
17.0	2.28E-01	7.87E-06
18.0	2.08E-01	7.19E-06
19.0	1.90E-01	6.56E-06
20.0	1.73E-01	5.98E-06

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	p-xylene			
Target Concentration (C_T)	0.5	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**p-xylene**		
Target concentration	C_T	**0.5**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.07E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	4.47E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**2.72E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.37E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.5	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**p-xylene**		from Level 1
Target concentration	C_T	**0.5**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**5.36E+02**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.47E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		p-xylene		from Level 1
Target Concentration	C_T	0.5	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1.7	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.12E+02	days	*Howard et al*
Calculated decay rate	λ	6.19E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.72E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	6.04E+01	fraction
Decay rate used	λ	1.02E-04	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	3.22E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	1.12E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**8.95E+01**	**fraction**
Calculated soil leachate concentration	Co	6.20E-02	mg/l

Remedial Targets

Level 3 Remedial Target	**4.80E+04**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.32E+06	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**1.12E-02**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	4.47E+02	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.72E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

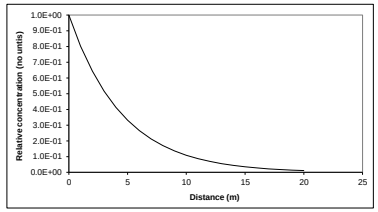
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	5.78E-05
1.0	8.02E-01	4.64E-05
2.0	6.43E-01	3.72E-05
3.0	5.16E-01	2.98E-05
4.0	4.14E-01	2.39E-05
5.0	3.32E-01	1.92E-05
6.0	2.66E-01	1.54E-05
7.0	2.13E-01	1.23E-05
8.0	1.70E-01	9.84E-06
9.0	1.36E-01	7.87E-06
10.0	1.09E-01	6.28E-06
11.0	8.67E-02	5.01E-06
12.0	6.92E-02	4.00E-06
13.0	5.51E-02	3.19E-06
14.0	4.39E-02	2.54E-06
15.0	3.50E-02	2.02E-06
16.0	2.78E-02	1.61E-06
17.0	2.22E-02	1.28E-06
18.0	1.76E-02	1.02E-06
19.0	1.40E-02	8.12E-07
20.0	1.12E-02	6.46E-07

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Arsenic**			
Target Concentration (C_T)	**0.01**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Arsenic**		
Target concentration	**C_T**	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

Level 1 Remedial Target

Level 1 Remedial Target	**5.00E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Arsenic**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.06E+03**		
Level 2 Remedial Target		**1.06E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		5.31E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Arsenic		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.06E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		150	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	1.78E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	3.00E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**1.15E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	5.75E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration	**C_{ED}/C_0 9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 5.00E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction
Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg
Sorption coefficient for ionised species — $K_{ow,i}$ — l/kg
pH value — pH
Acid dissociation constant — pKa
Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 5.00E+02 l/kg

Define dispersivity (click brown cell and use pull down list)

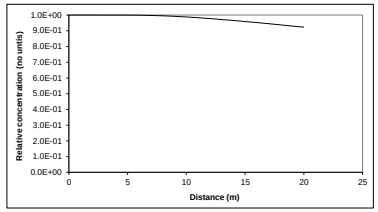
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.83E-04
1.0	1.00E+00	2.83E-04
2.0	1.00E+00	2.83E-04
3.0	1.00E+00	2.83E-04
4.0	1.00E+00	2.83E-04
5.0	1.00E+00	2.82E-04
6.0	9.99E-01	2.82E-04
7.0	9.97E-01	2.82E-04
8.0	9.95E-01	2.81E-04
9.0	9.92E-01	2.80E-04
10.0	9.88E-01	2.79E-04
11.0	9.83E-01	2.78E-04
12.0	9.78E-01	2.76E-04
13.0	9.72E-01	2.75E-04
14.0	9.65E-01	2.73E-04
15.0	9.59E-01	2.71E-04
16.0	9.52E-01	2.69E-04
17.0	9.45E-01	2.67E-04
18.0	9.38E-01	2.65E-04
19.0	9.30E-01	2.63E-04
20.0	9.23E-01	2.61E-04

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Chromium III			
Target Concentration (C_T)	0.05	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Chromium III**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	4.80E+03	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**4.80E+03**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.40E+02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Chromium III**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**5.35E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.57E+05	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Chromium III		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		46	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.80E+03	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	1.05E+04	fraction
Decay rate used	λ	6.61E-105	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	1.85E-06	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	9.58E-03	mg/l

Remedial Targets

Level 3 Remedial Target	**5.80E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	2.78E+05	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 4.80E+03 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction
Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg
Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg
pH value — pH
Acid dissociation constant — pKa
Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 4.80E+03 — l/kg

Define dispersivity (click brown cell and use pull down list)

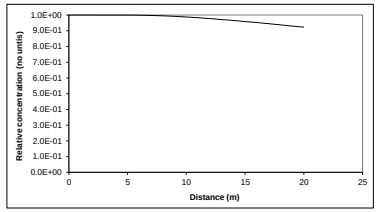
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	8.96E-06
1.0	1.00E+00	8.96E-06
2.0	1.00E+00	8.96E-06
3.0	1.00E+00	8.96E-06
4.0	1.00E+00	8.96E-06
5.0	1.00E+00	8.96E-06
6.0	9.99E-01	8.95E-06
7.0	9.97E-01	8.93E-06
8.0	9.95E-01	8.91E-06
9.0	9.92E-01	8.88E-06
10.0	9.88E-01	8.85E-06
11.0	9.83E-01	8.81E-06
12.0	9.78E-01	8.76E-06
13.0	9.72E-01	8.70E-06
14.0	9.65E-01	8.65E-06
15.0	9.59E-01	8.59E-06
16.0	9.52E-01	8.53E-06
17.0	9.45E-01	8.46E-06
18.0	9.38E-01	8.40E-06
19.0	9.30E-01	8.33E-06
20.0	9.23E-01	8.27E-06

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Chromium IV**			
Target Concentration (C_T)	**0.0034**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Chromium IV**		
Target concentration	C_T	**0.0034**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.80E+01	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.80E+01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**6.19E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0034	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Chromium IV**		from Level 1
Target concentration	**C_T**	**0.0034**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.04E+03**		
Level 2 Remedial Target		**3.54E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		6.44E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Chromium IV		from Level 1
Target Concentration	C_T	0.0034	mg/l	from Level 1
Dilution Factor	DF	1.04E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.5	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.80E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	4.03E+01	fraction
Decay rate used	λ	1.72E-102	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	4.82E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	2.75E-02	mg/l

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 1.80E+01 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction

Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 1.80E+01 — l/kg

Define dispersivity (click brown cell and use pull down list)

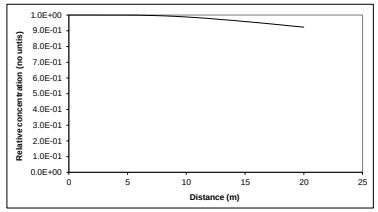
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.64E-05
1.0	1.00E+00	2.64E-05
2.0	1.00E+00	2.64E-05
3.0	1.00E+00	2.64E-05
4.0	1.00E+00	2.64E-05
5.0	1.00E+00	2.64E-05
6.0	9.99E-01	2.64E-05
7.0	9.97E-01	2.63E-05
8.0	9.95E-01	2.63E-05
9.0	9.92E-01	2.62E-05
10.0	9.88E-01	2.61E-05
11.0	9.83E-01	2.60E-05
12.0	9.78E-01	2.58E-05
13.0	9.72E-01	2.57E-05
14.0	9.65E-01	2.55E-05
15.0	9.59E-01	2.53E-05
16.0	9.52E-01	2.51E-05
17.0	9.45E-01	2.49E-05
18.0	9.38E-01	2.48E-05
19.0	9.30E-01	2.46E-05
20.0	9.23E-01	2.44E-05

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank		
Completed by:	Nicola Sellars		
Date:	########		
Version:	1		

Remedial Targets

Level 3 Remedial Target		**3.83E+00**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		6.98E+01	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		**20**	**m**	
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**9.23E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Copper**			
Target Concentration (C_T)	**2**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Copper**		
Target concentration	C_T	**2**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**1.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.00E+02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	2	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Copper**		from Level 1
Target concentration	C_T	**2**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**2.14E+03**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.15E+05	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		Copper		from Level 1
Target Concentration	C_T	2	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		2600	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	2.20E+02	fraction
Decay rate used	λ	3.16E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	8.86E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	2.59E+01	mg/l

Remedial Targets

Level 3 Remedial Target	**2.32E+03**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	2.33E+05	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration (C_{ED}/C_0)	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	1.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

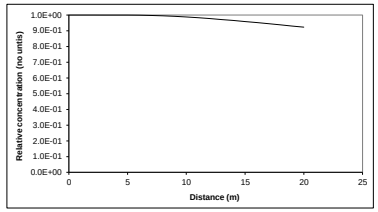
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.42E-02
1.0	1.00E+00	2.42E-02
2.0	1.00E+00	2.42E-02
3.0	1.00E+00	2.42E-02
4.0	1.00E+00	2.42E-02
5.0	1.00E+00	2.42E-02
6.0	9.99E-01	2.42E-02
7.0	9.97E-01	2.41E-02
8.0	9.95E-01	2.41E-02
9.0	9.92E-01	2.40E-02
10.0	9.88E-01	2.39E-02
11.0	9.83E-01	2.38E-02
12.0	9.78E-01	2.37E-02
13.0	9.72E-01	2.35E-02
14.0	9.65E-01	2.34E-02
15.0	9.59E-01	2.32E-02
16.0	9.52E-01	2.30E-02
17.0	9.45E-01	2.29E-02
18.0	9.38E-01	2.27E-02
19.0	9.30E-01	2.25E-02
20.0	9.23E-01	2.23E-02

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Cyanide			
Target Concentration (C_T)	0.05	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Cyanide**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	1.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.01E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Cyanide**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**5.35E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		5.36E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Cyanide		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		73	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	2.20E+02	fraction
Decay rate used	λ	3.16E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	8.86E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	7.29E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**5.80E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	5.81E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 1.00E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction
Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg
Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg
pH value — pH
Acid dissociation constant — pKa
Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 1.00E+02 — l/kg

Define dispersivity (click brown cell and use pull down list)

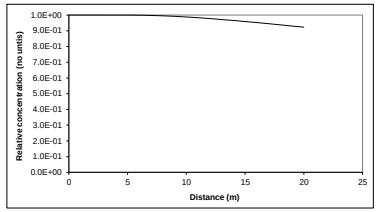
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	6.81E-04
1.0	1.00E+00	6.81E-04
2.0	1.00E+00	6.81E-04
3.0	1.00E+00	6.81E-04
4.0	1.00E+00	6.81E-04
5.0	1.00E+00	6.81E-04
6.0	9.99E-01	6.80E-04
7.0	9.97E-01	6.79E-04
8.0	9.95E-01	6.78E-04
9.0	9.92E-01	6.75E-04
10.0	9.88E-01	6.73E-04
11.0	9.83E-01	6.69E-04
12.0	9.78E-01	6.66E-04
13.0	9.72E-01	6.62E-04
14.0	9.65E-01	6.57E-04
15.0	9.59E-01	6.53E-04
16.0	9.52E-01	6.48E-04
17.0	9.45E-01	6.43E-04
18.0	9.38E-01	6.39E-04
19.0	9.30E-01	6.34E-04
20.0	9.23E-01	6.29E-04

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Lead			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Lead**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**5.00E+00**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Lead**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.06E+03**		
Level 2 Remedial Target		**1.06E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		5.31E+03	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Lead		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.06E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1100	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	1.78E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	2.20E+00	mg/l

Remedial Targets

Level 3 Remedial Target	**1.15E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	5.75E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 5.00E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction
Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg
Sorption coefficient for ionised species — $K_{w,i}$ — l/kg
pH value — pH
Acid dissociation constant — pKa
Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 5.00E+02 — l/kg

Define dispersivity (click brown cell and use pull down list)

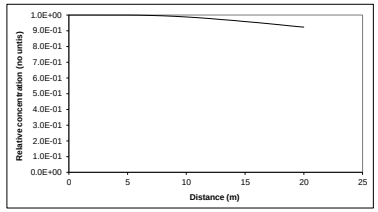
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.07E-03
1.0	1.00E+00	2.07E-03
2.0	1.00E+00	2.07E-03
3.0	1.00E+00	2.07E-03
4.0	1.00E+00	2.07E-03
5.0	1.00E+00	2.07E-03
6.0	9.99E-01	2.07E-03
7.0	9.97E-01	2.07E-03
8.0	9.95E-01	2.06E-03
9.0	9.92E-01	2.06E-03
10.0	9.88E-01	2.05E-03
11.0	9.83E-01	2.04E-03
12.0	9.78E-01	2.03E-03
13.0	9.72E-01	2.01E-03
14.0	9.65E-01	2.00E-03
15.0	9.59E-01	1.99E-03
16.0	9.52E-01	1.97E-03
17.0	9.45E-01	1.96E-03
18.0	9.38E-01	1.94E-03
19.0	9.30E-01	1.93E-03
20.0	9.23E-01	1.91E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**Manganese**			
Target Concentration (C_T)	**0.05**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Manganese**		
Target concentration	C_T	**0.05**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*Estimate*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.50E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.05	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Manganese**		from Level 1
Target concentration	C_T	**0.05**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**5.35E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.68E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C_T	0.05	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		1	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	1.78E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	2.00E-03	mg/l

Remedial Targets

Level 3 Remedial Target	**5.80E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	2.90E+04	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration (C_{ED}/C_0)	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction

Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

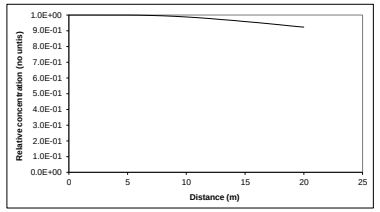
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	1.87E-06
1.0	1.00E+00	1.87E-06
2.0	1.00E+00	1.87E-06
3.0	1.00E+00	1.87E-06
4.0	1.00E+00	1.87E-06
5.0	1.00E+00	1.87E-06
6.0	9.99E-01	1.87E-06
7.0	9.97E-01	1.86E-06
8.0	9.95E-01	1.86E-06
9.0	9.92E-01	1.85E-06
10.0	9.88E-01	1.85E-06
11.0	9.83E-01	1.84E-06
12.0	9.78E-01	1.83E-06
13.0	9.72E-01	1.82E-06
14.0	9.65E-01	1.80E-06
15.0	9.59E-01	1.79E-06
16.0	9.52E-01	1.78E-06
17.0	9.45E-01	1.77E-06
18.0	9.38E-01	1.75E-06
19.0	9.30E-01	1.74E-06
20.0	9.23E-01	1.72E-06

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Naphthalene			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Naphthalene**		
Target concentration	C_T	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	6.62E-03	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.46E+02	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.93E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**3.95E-01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Naphthalene**		from Level 1
Target concentration	C_T	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.06E+03**		
Level 2 Remedial Target		**1.06E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		4.19E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
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Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters

	Variable	Value	Unit	Source
Contaminant		Naphthalene		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.06E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		19	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.58E+02	days	*Howard et al*
Calculated decay rate	λ	2.69E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.93E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters

	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	8.69E+01	fraction
Decay rate used	λ	3.09E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	2.24E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.69E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.03E+01**	**fraction**
Calculated soil leachate concentration	Co	4.81E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**1.10E+02**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	4.33E+03	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.69E-02**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	6.46E+02	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.93E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

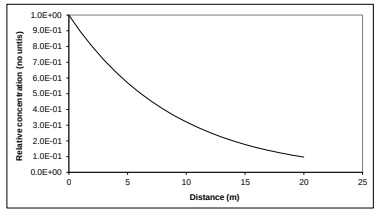
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	4.53E-04
1.0	8.93E-01	4.05E-04
2.0	7.98E-01	3.62E-04
3.0	7.13E-01	3.23E-04
4.0	6.37E-01	2.89E-04
5.0	5.69E-01	2.58E-04
6.0	5.08E-01	2.30E-04
7.0	4.53E-01	2.05E-04
8.0	4.04E-01	1.83E-04
9.0	3.60E-01	1.63E-04
10.0	3.20E-01	1.45E-04
11.0	2.84E-01	1.29E-04
12.0	2.53E-01	1.15E-04
13.0	2.24E-01	1.02E-04
14.0	1.99E-01	9.03E-05
15.0	1.77E-01	8.01E-05
16.0	1.57E-01	7.10E-05
17.0	1.39E-01	6.30E-05
18.0	1.23E-01	5.59E-05
19.0	1.09E-01	4.95E-05
20.0	9.69E-02	4.39E-05

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

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Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Nickel			
Target Concentration (C_T)	0.02	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
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The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Nickel**		
Target concentration	C_T	**0.02**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	5.00E+02	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**5.00E+02**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.00E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.02	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Nickel**		from Level 1
Target concentration	C_T	**0.02**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**2.13E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.07E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Nickel		from Level 1
Target Concentration	C_T	0.02	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		110	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	1.09E+03	fraction
Decay rate used	λ	6.34E-104	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	1.78E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	2.20E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**2.31E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.16E+04	**mg/kg**	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	**20**	**m**	Ogata Banks
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.23E-01**	**fraction**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	5.00E+02	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.00E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

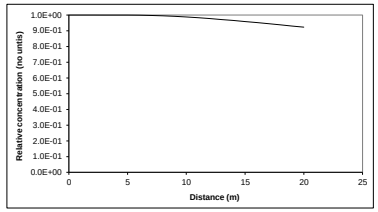
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.06E-04
1.0	1.00E+00	2.06E-04
2.0	1.00E+00	2.06E-04
3.0	1.00E+00	2.06E-04
4.0	1.00E+00	2.06E-04
5.0	1.00E+00	2.06E-04
6.0	9.99E-01	2.06E-04
7.0	9.97E-01	2.06E-04
8.0	9.95E-01	2.05E-04
9.0	9.92E-01	2.04E-04
10.0	9.88E-01	2.04E-04
11.0	9.83E-01	2.03E-04
12.0	9.78E-01	2.02E-04
13.0	9.72E-01	2.00E-04
14.0	9.65E-01	1.99E-04
15.0	9.59E-01	1.98E-04
16.0	9.52E-01	1.96E-04
17.0	9.45E-01	1.95E-04
18.0	9.38E-01	1.93E-04
19.0	9.30E-01	1.92E-04
20.0	9.23E-01	1.90E-04

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	TPH Aromatic C5-C7			
Target Concentration (C_T)	0.01	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C5-C7**		
Target concentration	**C_T**	**0.01**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.16E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	6.76E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**4.12E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.35E-02**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.01	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C5-C7**		from Level 1
Target concentration	**C_T**	**0.01**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.06E+03**		
Level 2 Remedial Target		**1.06E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		4.62E+01	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C5-C7		from Level 1
Target Concentration	C_T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.06E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		2.3	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	7.30E+02	days	*Howard et al*
Calculated decay rate	λ	9.50E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.12E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	1.00E+01	fraction
Decay rate used	λ	9.50E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	1.95E-03	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	3.77E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**2.65E+00**	**fraction**
Calculated soil leachate concentration	Co	5.29E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**2.82E+01**	**mg/l**
Ogata Banks		**or**	
		1.23E+02	**mg/kg**
Distance to compliance point		**20**	**m**
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**3.77E-01**	**fraction**

For comparison with measured pore water concentration.
This assumes Level 1 Remedial Target is based on Target Concentration.
For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	6.76E+01	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	4.12E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

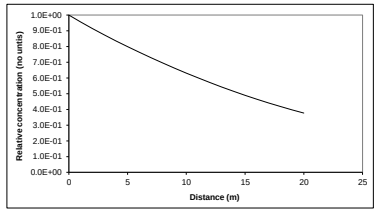
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	4.98E-04
1.0	9.56E-01	4.76E-04
2.0	9.14E-01	4.56E-04
3.0	8.74E-01	4.36E-04
4.0	8.36E-01	4.16E-04
5.0	7.99E-01	3.98E-04
6.0	7.63E-01	3.80E-04
7.0	7.29E-01	3.63E-04
8.0	6.95E-01	3.46E-04
9.0	6.63E-01	3.30E-04
10.0	6.31E-01	3.14E-04
11.0	6.00E-01	2.99E-04
12.0	5.71E-01	2.85E-04
13.0	5.43E-01	2.70E-04
14.0	5.16E-01	2.57E-04
15.0	4.90E-01	2.44E-04
16.0	4.65E-01	2.32E-04
17.0	4.41E-01	2.20E-04
18.0	4.19E-01	2.09E-04
19.0	3.97E-01	1.98E-04
20.0	3.77E-01	1.88E-04

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	TPH Aromatic C8-C10			
Target Concentration (C_T)	0.3	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C8-C10**		
Target concentration	**C_T**	**0.3**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	2.53E-01	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	1.58E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**9.65E+01**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.90E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.3	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C8-C10**		from Level 1
Target concentration	**C_T**	**0.3**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**3.21E+02**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		3.11E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C8-C10		from Level 1
Target Concentration	C_T	0.3	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		53	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.28E+02	days	*Howard et al*
Calculated decay rate	λ	3.04E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	9.65E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	2.12E+02	fraction
Decay rate used	λ	1.43E-05	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	9.18E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	7.57E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.32E+01**	**fraction**
Calculated soil leachate concentration	Co	5.48E-01	mg/l

Remedial Targets

Level 3 Remedial Target		**4.25E+03**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		4.11E+05	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**7.57E-02**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	1.58E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	9.65E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

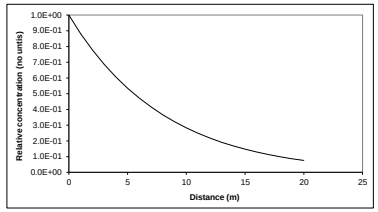
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	5.11E-04
1.0	8.82E-01	4.51E-04
2.0	7.79E-01	3.98E-04
3.0	6.87E-01	3.51E-04
4.0	6.06E-01	3.10E-04
5.0	5.35E-01	2.73E-04
6.0	4.72E-01	2.41E-04
7.0	4.16E-01	2.12E-04
8.0	3.66E-01	1.87E-04
9.0	3.22E-01	1.64E-04
10.0	2.83E-01	1.45E-04
11.0	2.48E-01	1.27E-04
12.0	2.18E-01	1.11E-04
13.0	1.91E-01	9.77E-05
14.0	1.68E-01	8.57E-05
15.0	1.47E-01	7.51E-05
16.0	1.29E-01	6.58E-05
17.0	1.13E-01	5.76E-05
18.0	9.88E-02	5.05E-05
19.0	8.65E-02	4.42E-05
20.0	7.57E-02	3.87E-05

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	TPH Aromatic C10-C12			
Target Concentration (C_T)	0.09	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C10-C12**		
Target concentration	**C_T**	**0.09**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	7.22E-02	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	2.51E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**1.53E+02**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**1.38E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.09	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C10-C12**		from Level 1
Target concentration	**C_T**	**0.09**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**9.64E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		1.48E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C10-C12		from Level 1
Target Concentration	C_T	0.09	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		40	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.58E+02	days	*Howard et al*
Calculated decay rate	λ	2.69E-03	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.53E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	3.35E+02	fraction
Decay rate used	λ	8.01E-06	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	5.80E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.69E-02	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.03E+01**	**fraction**
Calculated soil leachate concentration	Co	2.61E-01	mg/l

Remedial Targets

Level 3 Remedial Target	**9.95E+02**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.52E+05	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**9.69E-02**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — 6.09E-02 — fraction
Organic carbon partition coefficient — Koc — 2.51E+03 — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg
Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg
pH value — pH
Acid dissociation constant — pKa
Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 1.53E+02 — l/kg

Define dispersivity (click brown cell and use pull down list)

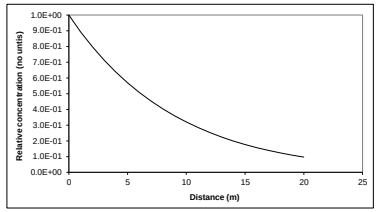
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.44E-04
1.0	8.93E-01	2.18E-04
2.0	7.98E-01	1.95E-04
3.0	7.13E-01	1.74E-04
4.0	6.37E-01	1.55E-04
5.0	5.69E-01	1.39E-04
6.0	5.08E-01	1.24E-04
7.0	4.53E-01	1.10E-04
8.0	4.04E-01	9.85E-05
9.0	3.60E-01	8.77E-05
10.0	3.20E-01	7.80E-05
11.0	2.84E-01	6.94E-05
12.0	2.53E-01	6.16E-05
13.0	2.24E-01	5.47E-05
14.0	1.99E-01	4.86E-05
15.0	1.77E-01	4.31E-05
16.0	1.57E-01	3.82E-05
17.0	1.39E-01	3.39E-05
18.0	1.23E-01	3.01E-05
19.0	1.09E-01	2.67E-05
20.0	9.69E-02	2.36E-05

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**Ryebank**			
Site Address:	**Chorlton**			
Completed by:	**Nicola Sellars**			
Date:	**26-Nov-24**		**Version:**	**1**
Contaminant	**TPH Aromatic C12-C16**			
Target Concentration (C_T)	**0.09**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**TPH Aromatic C12-C16**		
Target concentration	**C_T**	**0.09**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	1.26E-03	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	5.01E+03	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.05E+02**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**2.75E+01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.09	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**TPH Aromatic C12-C16**		from Level 1
Target concentration	**C_T**	**0.09**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.07E+03**		
Level 2 Remedial Target		**9.64E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		2.94E+04	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Environment Agency

Input Parameters	Variable	Value	Unit	Source
Contaminant		TPH Aromatic C12-C16		from Level 1
Target Concentration	C_T	0.09	mg/l	from Level 1
Dilution Factor	DF	1.07E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		200	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.84E+03	days	*Howard et al*
Calculated decay rate	λ	3.77E-04	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.05E+02	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	6.68E+02	fraction
Decay rate used	λ	5.64E-07	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	2.91E-05	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	6.35E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.57E+00**	**fraction**
Calculated soil leachate concentration	Co	6.55E-01	mg/l

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	5.01E+03	l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.05E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

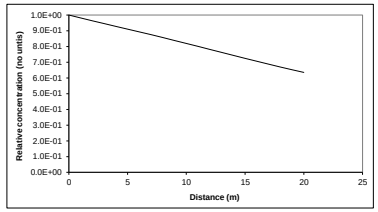
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	6.12E-04
1.0	9.82E-01	6.00E-04
2.0	9.63E-01	5.89E-04
3.0	9.46E-01	5.78E-04
4.0	9.28E-01	5.68E-04
5.0	9.11E-01	5.57E-04
6.0	8.93E-01	5.46E-04
7.0	8.75E-01	5.35E-04
8.0	8.57E-01	5.24E-04
9.0	8.38E-01	5.13E-04
10.0	8.19E-01	5.01E-04
11.0	8.00E-01	4.90E-04
12.0	7.81E-01	4.78E-04
13.0	7.62E-01	4.66E-04
14.0	7.43E-01	4.55E-04
15.0	7.25E-01	4.43E-04
16.0	7.06E-01	4.32E-04
17.0	6.88E-01	4.21E-04
18.0	6.70E-01	4.10E-04
19.0	6.52E-01	3.99E-04
20.0	6.35E-01	3.89E-04

Remedial Targets

Level 3 Remedial Target		**1.52E+02**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		4.63E+04	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**6.35E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Trichloromethane			
Target Concentration (C_T)	0.0025	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

Calculate for non-polar organic chemicals

Contaminant		**Trichloromethane**		
Target concentration	C_T	**0.0025**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	7.65E-02	dimensionless	*LQM CIEH*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd		l/kg	
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc	6.09E-02	fraction	Site soil samples
Organic carbon partition coefficient	Koc	5.01E+01	l/kg	*LQM CIEH*
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	
Soil water partition coefficient used in Level Assessment	**Kd**	**3.05E+00**	**l/kg**	*Calculated value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**8.19E-03**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0025	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Trichloromethane**		from Level 1
Target concentration	C_T	**0.0025**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.03E+03**		
Level 2 Remedial Target		**2.57E+00**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		8.43E+00	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Trichloromethane		from Level 1
Target Concentration	C_T	0.0025	mg/l	from Level 1
Dilution Factor	DF	1.03E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		0.001	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	2.80E+01	days	*Howard et al*
Calculated decay rate	λ	2.48E-02	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.05E+00	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	7.67E+00	fraction
Decay rate used	λ	3.23E-03	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	2.54E-03	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	7.51E-06	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.33E+05**	**fraction**
Calculated soil leachate concentration	Co	3.05E-04	mg/l

Remedial Targets

Level 3 Remedial Target	**3.43E+05**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks	**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.12E+06	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point	**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration C_{ED}/C_0	**7.51E-06**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.09E-02	fraction
Organic carbon partition coefficient	Koc	5.01E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	3.05E+00	l/kg

Define dispersivity (click brown cell and use pull down list)

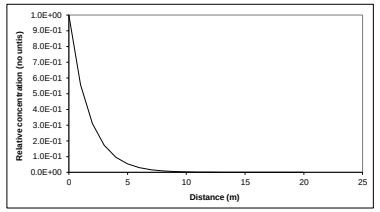
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	########
Version:	1

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.97E-07
1.0	5.57E-01	1.65E-07
2.0	3.10E-01	9.19E-08
3.0	1.72E-01	5.12E-08
4.0	9.60E-02	2.85E-08
5.0	5.34E-02	1.58E-08
6.0	2.97E-02	8.81E-09
7.0	1.65E-02	4.90E-09
8.0	9.16E-03	2.72E-09
9.0	5.08E-03	1.51E-09
10.0	2.82E-03	8.36E-10
11.0	1.56E-03	4.63E-10
12.0	8.64E-04	2.56E-10
13.0	4.78E-04	1.42E-10
14.0	2.64E-04	7.84E-11
15.0	1.46E-04	4.33E-11
16.0	8.07E-05	2.40E-11
17.0	4.46E-05	1.32E-11
18.0	2.46E-05	7.31E-12
19.0	1.36E-05	4.04E-12
20.0	7.51E-06	2.23E-12

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	Ryebank			
Site Address:	Chorlton			
Completed by:	Nicola Sellars			
Date:	26-Nov-24		Version:	1
Contaminant	Zinc			
Target Concentration (C_T)	0.0109	mg/l	Origin of C_T:	EQS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil

Select the method of calculating the soil water Partition Co-efficient by using the pull down menu below

User specified value for partition coefficient

Contaminant		**Zinc**		
Target concentration	C_T	**0.0109**	**mg/l**	

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**
Standard entry				
Water filled soil porosity	θ_w	2.40E-01	fraction	SR3 sand
Air filled soil porosity	θa	3.00E-01	fraction	SR3 sand
Bulk density of soil zone material	ρ	1.18E+00	g/cm^3	SR3 sand
Henry's Law constant	H	0.00E+00	dimensionless	*EA*
Entry if specify partition coefficient (option)				
Soil water partition coefficient	Kd	3.80E+01	l/kg	*LQM CIEH*
Entry for non-polar organic chemicals (option)				
Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	
Entry for ionic organic chemicals (option)				
Sorption coefficient for neutral species	$K_{oc,n}$		l/kg	
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg	
pH value	pH		pH units	
Acid dissociation constant	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	**Kd**	**3.80E+01**	**l/kg**	*Specified value*

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.

The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Level 1 Remedial Target

Level 1 Remedial Target	**4.16E-01**	**mg/kg**	**(for comparison with soil analyses)**
	or		
	0.0109	**mg/l**	**(for comparison with leachate test results)**

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 2 - Soil

Contaminant		**Zinc**		from Level 1
Target concentration	**C_T**	**0.0109**	**mg/l**	from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamiantion' (Environment Agency 2006)

Input Parameters	**Variable**	**Value**	**Unit**	**Source of parameter value**	
Standard entry					
Infiltration	Inf	1.47E-05	m/d		
Area of contaminant source	A	1.00E+02	m^2	**10 m x 10 m**	Not used in calculation
Entry for groundwater flow below site					
Length of contaminant source in direction of groundwater flow	L	1.00E+01	m		
Saturated aquifer thickness	da	1.80E+01	m		
Hydraulic Conductivity of aquifer in which dilution occurs	K	6.36E+00	m/d	**SR3 sand**	
Hydraulic gradient of water table	i	1.65E-03	fraction		
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m		Not used in calculation
Background concentration of contaminant in groundwater beneath site	Cu	1.00E-04	mg/l		
Define mixing zone depth by specifying or calculating depth (using pull down list)		**Specify**			
Enter mixing zone thickness	Mz	1.50E+01	m		
Calculated mixing zone thickness	Mz		m		

Calculated Parameters

Dilution Factor	**DF**	**1.06E+03**		
Level 2 Remedial Target		**1.16E+01**	**mg/l**	**For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentra**
		or		
		4.42E+02	**mg/kg**	**For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water**

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ryebank
Completed by:	Nicola Sellars
Date:	26-Nov-24
Version:	1

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note

Input Parameters	Variable	Value	Unit	Source
Contaminant		Zinc		from Level 1
Target Concentration	C_T	0.0109	mg/l	from Level 1
Dilution Factor	DF	1.06E+03		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: **Apply degradation rate to dissolved pollutants only**

	Variable	Value	Unit	Source of parameter value
Enter source concentration		Soil concentration as mg/kg		
Enter soil concentration		2500	mg/kg	
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+100	days	*EA*
Calculated decay rate	λ	6.93E-101	$days^{-1}$	calculated
Width of plume in aquifer at source	Sz	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	Sy	1.50E+01	m	from Level 2
Bulk density of aquifer materials	ρ	1.18E+00	g/cm^3	*SR3 sand*
Effective porosity of aquifer	n	5.40E-01	fraction	
Hydraulic gradient	i	1.65E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	6.36E+00	m/d	from Level 2
Distance to compliance point	x	2.00E+01	m	*Distance to principal aquifer*
Distance (lateral) to compliance point perpendicular to flow direction	z		m	
Distance (depth) to compliance point perpendicular to flow direction	y		m	
Time since pollutant entered groundwater	t	1.00E+99	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.80E+01	l/kg	*see options*
Longitudinal dispersivity	ax	2.000	m	*see options*
Transverse dispersivity	az	0.200	m	*see options*
Vertical dispersivity	ay	0.020	m	*see options*

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable		
Groundwater flow velocity	v	1.95E-02	m/d
Retardation factor	Rf	8.40E+01	fraction
Decay rate used	λ	8.25E-103	d^{-1}
Hydraulic gradient used in aquifer flow down-gradient	i	1.65E-03	fraction
Rate of contaminant flow due to retardation	u	2.31E-04	m/d
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	9.23E-01	fraction
Attenuation factor (C_0/C_{ED})	**AF**	**1.08E+00**	**fraction**
Calculated soil leachate concentration	Co	6.54E+01	mg/l

Enter method of defining partition co-efficient (using pull down list)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — 3.80E+01 — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — fraction

Organic carbon partition coefficient — Koc — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

Acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 3.80E+01 — l/kg

Define dispersivity (click brown cell and use pull down list)

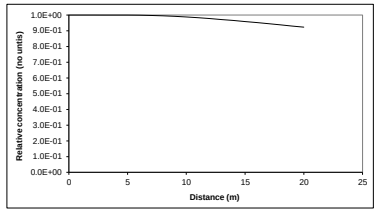
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	2.00E+00	1.57E+00	m
Transverse dispersivity	**az**	0.00E+00	2.00E-01	1.57E-01	m
Vertical dispersivity	**ay**	0.00E+00	2.00E-02	1.57E-02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Note
This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O_2, NO_3, SO_4 etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentation at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	6.16E-02
1.0	1.00E+00	6.16E-02
2.0	1.00E+00	6.16E-02
3.0	1.00E+00	6.16E-02
4.0	1.00E+00	6.16E-02
5.0	1.00E+00	6.16E-02
6.0	9.99E-01	6.15E-02
7.0	9.97E-01	6.14E-02
8.0	9.95E-01	6.13E-02
9.0	9.92E-01	6.11E-02
10.0	9.88E-01	6.09E-02
11.0	9.83E-01	6.06E-02
12.0	9.78E-01	6.02E-02
13.0	9.72E-01	5.99E-02
14.0	9.65E-01	5.95E-02
15.0	9.59E-01	5.91E-02
16.0	9.52E-01	5.87E-02
17.0	9.45E-01	5.82E-02
18.0	9.38E-01	5.78E-02
19.0	9.30E-01	5.73E-02
20.0	9.23E-01	5.69E-02

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed:	Ryebank		
Completed by:	Nicola Sellars		
Date:	########		
Version:	1		

Remedial Targets

Level 3 Remedial Target		**1.25E+01**	**mg/l**	For comparison with measured pore water concentration.
Ogata Banks		**or**		This assumes Level 1 Remedial Target is based on Target Concentration.
		4.79E+02	**mg/kg**	For comparison with measured soil concentration. This
Distance to compliance point		**20**	**m**	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C_{ED}/C_0	**9.23E-01**	**fraction**	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99

APPENDIX III
CHEMICAL
TESTING RESULTS



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Combine Report Ryebank Chorlton

Project / Site name:	Ryebank Chorlton	**Samples received on:**	06/12/2019
Your job number:	13533	**Samples instructed on:**	09/12/2019
Your order number:	34146	**Analysis completed by:**	16/12/2019
Report Issue Number:	1	**Report issued on:**	09/01/2020
Samples Analysed:	4 leachate samples - 17 soil samples		

Signed:

Zina Abdul Razzak
Senior Quality Specialist

For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386182	1386183	1386184	1386186	1386187
Sample Reference				TP103	TP105	TP111	TP115	TP116
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.30	0.10	1.20	1.60	1.50
Date Sampled				04/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	13	25	33	23	14
Total mass of sample received	kg	0.001	NONE	0.39	0.44	0.30	0.35	0.39
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	9.0	-	12.3	11.2
Total Cyanide	mg/kg	1	MCERTS	1	< 1	< 1	< 1	1
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	650	-	3200	770
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	-	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	-	0.046	-	0.15	0.11
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	-	91	-	300	220
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	-	45.6	-	152	111
Sulphide	mg/kg	1	MCERTS	-	7.0	-	91	36
Total Sulphur	mg/kg	50	MCERTS	-	610	-	1600	1100
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.8	-	-	-	2.4
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	-	1.2	< 1.0

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386182	1386183	1386184	1386186	1386187
Sample Reference				TP103	TP105	TP111	TP115	TP116
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.30	0.10	1.20	1.60	1.50
Date Sampled				04/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.35	< 0.05	< 0.05	< 0.05	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	-
Acenaphthene	mg/kg	0.05	MCERTS	0.59	0.76	< 0.05	< 0.05	-
Fluorene	mg/kg	0.05	MCERTS	0.59	0.53	< 0.05	< 0.05	-
Phenanthrene	mg/kg	0.05	MCERTS	4.0	5.1	< 0.05	< 0.05	-
Anthracene	mg/kg	0.05	MCERTS	0.93	1.0	< 0.05	< 0.05	-
Fluoranthene	mg/kg	0.05	MCERTS	5.8	5.9	< 0.05	< 0.05	-
Pyrene	mg/kg	0.05	MCERTS	5.2	5.8	< 0.05	< 0.05	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.1	3.4	< 0.05	< 0.05	-
Chrysene	mg/kg	0.05	MCERTS	2.8	2.8	< 0.05	< 0.05	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	3.0	2.8	< 0.05	< 0.05	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.5	1.5	< 0.05	< 0.05	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.7	2.7	< 0.05	< 0.05	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.3	1.2	< 0.05	< 0.05	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.42	0.39	< 0.05	< 0.05	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.5	1.5	< 0.05	< 0.05	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	33.7	35.4	< 0.80	< 0.80	-

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Your Order No: 34146

Lab Sample Number				1386182	1386183	1386184	1386186	1386187
Sample Reference				TP103	TP105	TP111	TP115	TP116
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.30	0.10	1.20	1.60	1.50
Date Sampled				04/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	15	21	< 1.0	< 1.0	20
Barium (aqua regia extractable)	mg/kg	1	MCERTS	290	-	12	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.2	-	0.67	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	0.8	< 0.2	< 0.2	1.8
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	36	-	26	23
Copper (aqua regia extractable)	mg/kg	1	MCERTS	99	120	10	14	160
Lead (aqua regia extractable)	mg/kg	1	MCERTS	180	820	7.4	4.8	180
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.3	0.6	< 0.3	< 0.3	2.8
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	23	3.9	4.6	40
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	1.7
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	32	-	5.7	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	230	310	6.0	58	530

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Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.30	0.10	1.20	1.60	1.50
Date Sampled				04/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Toluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
o-xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Petroleum Hydrocarbons								

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Lab Sample Number				1386182	1386183	1386184	1386186	1386187
Sample Reference				TP103	TP105	TP111	TP115	TP116
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.30	0.10	1.20	1.60	1.50
Date Sampled				04/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	8.1
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	35
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	67
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	110
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	7.9
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	200
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	1100
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	910
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	2200
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	-
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	-
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	-
TPH (C10 - C12)	mg/kg	2	MCERTS	40	3.8	< 2.0	< 2.0	-
TPH (C12 - C16)	mg/kg	4	MCERTS	21	14	< 4.0	< 4.0	-
TPH (C16 - C21)	mg/kg	1	MCERTS	67	47	< 1.0	10	-
TPH (C21 - C35)	mg/kg	1	MCERTS	170	110	< 1.0	78	-
TPH (C35 - C40)	mg/kg	10	MCERTS	42	22	< 10	< 10	-
TPH Total C5 - C40	mg/kg	10	MCERTS	390	200	< 10	91	-

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Sample Reference				TP103	TP105	TP111	TP115	TP116
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.30	0.10	1.20	1.60	1.50
Date Sampled				04/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Chloroethane	µg/kg	1	NONE	-	-	-	-	< 1.0
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
Benzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Toluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Styrene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Tribromomethane	µg/kg	1	NONE	-	-	-	-	< 1.0
o-Xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386182	1386183	1386184	1386186	1386187
Sample Reference				TP103	TP105	TP111	TP115	TP116
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.30	0.10	1.20	1.60	1.50
Date Sampled				04/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	-	-	-	-	< 0.1
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	< 0.2
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Hexachloroethane	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	< 0.2
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	< 0.1
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	< 0.1
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	0.5
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	0.62
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	5.7
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	3.6
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-	-	-	< 0.3
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	9.1
Azobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	55
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	17
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	4.1
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Anthraquinone	mg/kg	0.3	MCERTS	-	-	-	-	1.8
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	53
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	42
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-	-	-	< 0.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	19
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	16
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	14
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	6.9
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	13
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	7.5
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	2.1
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	7.9

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386182	1386183	1386184	1386186	1386187
Sample Reference				TP103	TP105	TP111	TP115	TP116
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.30	0.10	1.20	1.60	1.50
Date Sampled				04/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386189	1386190	1386191	1386192	1386193
Sample Reference				TP127	TP128	WS101	WS102	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.80	1.80	3.20	3.80
Date Sampled				05/12/2019	05/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	13	13	23	22	36
Total mass of sample received	kg	0.001	NONE	0.39	0.38	0.30	0.41	0.31
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Chrysotile & Amosite	Chrysotile	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Detected	Detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	1.183	0.036	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	1.18	0.036	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	U/S	9.0	12.4
Total Cyanide	mg/kg	1	MCERTS	1	6	2	1	3
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-	U/S	4900	3500
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	-	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	-	-	U/S	0.97	0.055
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	-	-	U/S	1900	110
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	-	-	U/S	966	55.3
Sulphide	mg/kg	1	MCERTS	-	-	U/S	470	19
Total Sulphur	mg/kg	50	MCERTS	-	-	U/S	17000	1600
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.9	-	U/S	3.2	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	< 1.0	< 1.0	47

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386189	1386190	1386191	1386192	1386193
Sample Reference				TP127	TP128	WS101	WS102	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.80	1.80	3.20	3.80
Date Sampled				05/12/2019	05/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	-	0.45	-	-	0.61
Acenaphthylene	mg/kg	0.05	MCERTS	-	0.47	-	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	2.8	-	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	2.7	-	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	19	-	-	0.23
Anthracene	mg/kg	0.05	MCERTS	-	5.4	-	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	25	-	-	0.33
Pyrene	mg/kg	0.05	MCERTS	-	21	-	-	0.29
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	10	-	-	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	8.7	-	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	11	-	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	3.9	-	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	8.9	-	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	3.8	-	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	1.1	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	4.4	-	-	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	127	-	-	1.46

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Combine Report Ryebank Chorlton

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Your Order No: 34146

Lab Sample Number				1386189	1386190	1386191	1386192	1386193
Sample Reference				TP127	TP128	WS101	WS102	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.80	1.80	3.20	3.80
Date Sampled				05/12/2019	05/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	18	U/S	34	1.4
Barium (aqua regia extractable)	mg/kg	1	MCERTS	350	380	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.1	0.98	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5	1.2	U/S	3.3	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	U/S	43	6.0
Copper (aqua regia extractable)	mg/kg	1	MCERTS	130	2600	U/S	400	14
Lead (aqua regia extractable)	mg/kg	1	MCERTS	230	460	U/S	1100	16
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.6	U/S	1.0	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	22	25	U/S	58	6.2
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.1	U/S	2.1	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	34	28	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	260	760	U/S	1600	23

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Lab Sample Number				1386189	1386190	1386191	1386192	1386193
Sample Reference				TP127	TP128	WS101	WS102	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.80	1.80	3.20	3.80
Date Sampled				05/12/2019	05/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
o-xylene	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-

Petroleum Hydrocarbons

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Your Order No: 34146

Lab Sample Number				1386189	1386190	1386191	1386192	1386193
Sample Reference				TP127	TP128	WS101	WS102	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.80	1.80	3.20	3.80
Date Sampled				05/12/2019	05/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	2.5	-	-	13	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	11	-	-	20	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	25	-	-	76	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	49	-	-	450	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	88	-	-	560	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-	< 0.001	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	5.5	-	-	6.2	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	41	-	-	34	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	110	-	-	180	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	250	-	-	510	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	410	-	-	730	-
TPH (C5 - C6)	mg/kg	1	NONE	-	< 1.0	< 1.0	-	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	-	2.3	U/S	-	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	-	22	U/S	-	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	-	150	U/S	-	7.9
TPH (C21 - C35)	mg/kg	1	MCERTS	-	460	U/S	-	85
TPH (C35 - C40)	mg/kg	10	MCERTS	-	47	U/S	-	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	-	680	< 10	-	95

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Your Order No: 34146

Lab Sample Number				1386189	1386190	1386191	1386192	1386193
Sample Reference				TP127	TP128	WS101	WS102	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.80	1.80	3.20	3.80
Date Sampled				05/12/2019	05/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
Chloroethane	µg/kg	1	NONE	< 1.0	-	< 1.0	< 1.0	-
Bromomethane	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
Vinyl Chloride	µg/kg	1	NONE	< 1.0	-	< 1.0	< 1.0	-
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	-	< 1.0	< 1.0	-
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	-	< 1.0	< 1.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Trichloromethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	< 1.0	< 1.0	-
Benzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Trichloroethene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Dibromomethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
Toluene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
Tetrachloroethene	µg/kg	1	NONE	< 1.0	-	< 1.0	< 1.0	-
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
Chlorobenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
p & m-Xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Styrene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Tribromomethane	µg/kg	1	NONE	< 1.0	-	< 1.0	< 1.0	-
o-Xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Bromobenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Butylbenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	-
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0	-	< 1.0	< 1.0	-

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386189	1386190	1386191	1386192	1386193
Sample Reference				TP127	TP128	WS101	WS102	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.80	1.80	3.20	3.80
Date Sampled				05/12/2019	05/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	< 0.1	-	U/S	< 0.1	-
Phenol	mg/kg	0.2	ISO 17025	< 0.2	-	U/S	< 0.2	-
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	U/S	< 0.1	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	< 0.1	-	U/S	< 0.1	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	< 0.1	-	U/S	< 0.1	-
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	-	U/S	< 0.3	-
Hexachloroethane	mg/kg	0.05	MCERTS	< 0.05	-	U/S	< 0.05	-
Nitrobenzene	mg/kg	0.3	MCERTS	< 0.3	-	U/S	< 0.3	-
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	-	U/S	< 0.2	-
Isophorone	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
2-Nitrophenol	mg/kg	0.3	MCERTS	< 0.3	-	U/S	< 0.3	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	< 0.3	-	U/S	< 0.3	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	< 0.3	-	U/S	< 0.3	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	U/S	< 0.3	-
Naphthalene	mg/kg	0.05	MCERTS	5.1	-	U/S	1.4	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	< 0.3	-	U/S	< 0.3	-
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	-	U/S	< 0.1	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	< 0.1	-	U/S	< 0.1	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	-	U/S	< 0.1	-
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	< 0.1	-	U/S	< 0.1	-
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
2-Methylnaphthalene	mg/kg	0.1	NONE	4.0	-	U/S	0.7	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	< 0.1	-	U/S	< 0.1	-
Dimethylphthalate	mg/kg	0.1	MCERTS	< 0.1	-	U/S	< 0.1	-
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	< 0.1	-	U/S	< 0.1	-
Acenaphthylene	mg/kg	0.05	MCERTS	2.4	-	U/S	0.61	-
Acenaphthene	mg/kg	0.05	MCERTS	4.6	-	U/S	3.0	-
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
Dibenzofuran	mg/kg	0.2	MCERTS	3.0	-	U/S	1.1	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	< 0.3	-	U/S	< 0.3	-
Diethyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
4-Nitroaniline	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
Fluorene	mg/kg	0.05	MCERTS	5.7	-	U/S	3.6	-
Azobenzene	mg/kg	0.3	MCERTS	< 0.3	-	U/S	< 0.3	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	< 0.3	-	U/S	< 0.3	-
Phenanthrene	mg/kg	0.05	MCERTS	24	-	U/S	19	-
Anthracene	mg/kg	0.05	MCERTS	7.5	-	U/S	5.6	-
Carbazole	mg/kg	0.3	MCERTS	2.3	-	U/S	1.1	-
Dibutyl phthalate	mg/kg	0.2	MCERTS	< 0.2	-	U/S	< 0.2	-
Anthraquinone	mg/kg	0.3	MCERTS	< 0.3	-	U/S	0.9	-
Fluoranthene	mg/kg	0.05	MCERTS	27	-	U/S	25	-
Pyrene	mg/kg	0.05	MCERTS	22	-	U/S	21	-
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	< 0.3	-	U/S	< 0.3	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	12	-	U/S	9.6	-
Chrysene	mg/kg	0.05	MCERTS	9.2	-	U/S	9.9	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	10	-	U/S	8.5	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	5.9	-	U/S	4.8	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	9.7	-	U/S	7.6	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	4.1	-	U/S	4.4	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	1.1	-	U/S	1.4	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	4.6	-	U/S	4.6	-

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386189	1386190	1386191	1386192	1386193
Sample Reference				TP127	TP128	WS101	WS102	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.80	1.80	3.20	3.80
Date Sampled				05/12/2019	05/12/2019	04/12/2019	04/12/2019	04/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386194	1389778	1389779	1389780	1389781
Sample Reference				WS112	TP101	TP113	TP119	TP120
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.10	0.10	0.10	2.10
Date Sampled				05/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	14	39	23	14	17
Total mass of sample received	kg	0.001	NONE	0.41	0.33	0.31	0.34	0.36
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	0.014	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	0.014	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	-	-	10.3
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	2	120	2
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-	-	-	1100
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	-	-	250
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	-	0.13
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	-	125
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	-	-	-	-	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	-	-	-	-	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	-	-	-	-	-
Sulphide	mg/kg	1	MCERTS	-	-	-	-	2.3
Total Sulphur	mg/kg	50	MCERTS	-	-	-	-	1300
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.1	-	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	-	< 1.0

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386194	1389778	1389779	1389780	1389781
Sample Reference				WS112	TP101	TP113	TP119	TP120
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.10	0.10	0.10	2.10
Date Sampled				05/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.94	0.54	< 0.05	< 0.05	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	11	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.35	< 0.05	2.4	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.39	< 0.05	17	-
Phenanthrene	mg/kg	0.05	MCERTS	0.54	3.1	0.81	150	-
Anthracene	mg/kg	0.05	MCERTS	0.11	0.90	0.25	46	-
Fluoranthene	mg/kg	0.05	MCERTS	0.51	5.1	1.7	150	-
Pyrene	mg/kg	0.05	MCERTS	0.54	5.2	1.8	130	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.29	2.4	0.91	44	-
Chrysene	mg/kg	0.05	MCERTS	0.27	2.3	1.0	37	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.31	3.0	1.1	50	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.14	0.98	0.59	15	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.22	2.5	1.1	45	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	1.3	0.51	30	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.44	0.20	7.2	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	1.5	0.58	25	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	3.87	30.0	10.6	763	-

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386194	1389778	1389779	1389780	1389781
Sample Reference				WS112	TP101	TP113	TP119	TP120
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.10	0.10	0.10	2.10
Date Sampled				05/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	15	13	17	23	32
Barium (aqua regia extractable)	mg/kg	1	MCERTS	780	200	150	440	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	5.0	0.64	0.79	1.2	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	2.0	0.7	0.4	1.6	0.4
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	24
Copper (aqua regia extractable)	mg/kg	1	MCERTS	320	150	72	620	160
Lead (aqua regia extractable)	mg/kg	1	MCERTS	110	220	180	1000	680
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.5	0.7	1.4	1.0
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	80	14	17	27	33
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	3.8	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	100	16	21	32	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	2500	320	130	1000	280

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386194	1389778	1389779	1389780	1389781
Sample Reference				WS112	TP101	TP113	TP119	TP120
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.10	0.10	0.10	2.10
Date Sampled				05/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	-	-	-	-	-
Toluene	µg/kg	1	MCERTS	-	-	-	-	-
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	-
p & m-xylene	µg/kg	1	MCERTS	-	-	-	-	-
o-xylene	µg/kg	1	MCERTS	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	-

Petroleum Hydrocarbons

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386194	1389778	1389779	1389780	1389781
Sample Reference				WS112	TP101	TP113	TP119	TP120
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.10	0.10	0.10	2.10
Date Sampled				05/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	-
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	4.4	5.6	3.7	6.3	12
TPH (C12 - C16)	mg/kg	4	MCERTS	9.6	13	16	220	40
TPH (C16 - C21)	mg/kg	1	MCERTS	33	44	51	1700	140
TPH (C21 - C35)	mg/kg	1	MCERTS	85	110	110	1300	230
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	19	20	40	18
TPH Total C5 - C40	mg/kg	10	MCERTS	140	200	200	3300	460

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386194	1389778	1389779	1389780	1389781
Sample Reference				WS112	TP101	TP113	TP119	TP120
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.10	0.10	0.10	2.10
Date Sampled				05/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Chloroethane	µg/kg	1	NONE	-	-	-	-	< 1.0
Bromomethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-	< 1.0
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-	< 1.0
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trichloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
Benzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Tetrachloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Trichloroethene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Dibromomethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Bromodichloromethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Toluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Dibromochloromethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-	< 1.0
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
Chlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
p & m-Xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Styrene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Tribromomethane	µg/kg	1	NONE	-	-	-	-	< 1.0
o-Xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Isopropylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Bromobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
n-Propylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
2-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
4-Chlorotoluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
tert-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
sec-Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Butylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-	-	-	< 1.0
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-	-	-	< 1.0

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386194	1389778	1389779	1389780	1389781
Sample Reference				WS112	TP101	TP113	TP119	TP120
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.10	0.10	0.10	2.10
Date Sampled				05/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	-	-	-	-	< 0.1
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	< 0.2
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Hexachloroethane	mg/kg	0.05	MCERTS	-	-	-	-	< 0.05
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	< 0.2
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	0.61
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	< 0.1
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	< 0.1
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	0.7
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	0.72
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	0.94
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	0.5
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-	-	-	< 0.3
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	1.5
Azobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	11
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	2.0
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	0.4
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Anthraquinone	mg/kg	0.3	MCERTS	-	-	-	-	< 0.3
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	14
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	14
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-	-	-	< 0.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	6.8
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	5.5
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	6.6
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	2.5
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	5.6
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	2.8
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	1.0
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	3.6

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1386194	1389778	1389779	1389780	1389781
Sample Reference				WS112	TP101	TP113	TP119	TP120
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.30	0.10	0.10	0.10	2.10
Date Sampled				05/12/2019	04/12/2019	05/12/2019	05/12/2019	05/12/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1389782	1389783			
Sample Reference				TP125	WS110			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				05/12/2019	05/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	30	11			
Total mass of sample received	kg	0.001	NONE	0.38	0.36			
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Chrysotile			
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Detected			
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	< 0.001			
Asbestos Quantification Total	%	0.001	ISO 17025	-	< 0.001			
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-			
Total Cyanide	mg/kg	1	MCERTS	< 1	-			
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-			
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-			
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-			
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-			
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	-	-			
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	-	-			
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	-	-			
Sulphide	mg/kg	1	MCERTS	-	-			
Total Sulphur	mg/kg	50	MCERTS	-	-			
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	1.6			
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-			

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1389782	1389783			
Sample Reference				TP125	WS110			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				05/12/2019	05/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.32			
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.24			
Phenanthrene	mg/kg	0.05	MCERTS	3.1	1.3			
Anthracene	mg/kg	0.05	MCERTS	0.90	0.36			
Fluoranthene	mg/kg	0.05	MCERTS	5.8	1.7			
Pyrene	mg/kg	0.05	MCERTS	5.7	1.5			
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.5	1.2			
Chrysene	mg/kg	0.05	MCERTS	2.6	0.82			
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	3.3	0.77			
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.2	0.50			
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.8	0.66			
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.5	0.33			
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.42	< 0.05			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.7	0.40			
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	31.3	10.0			

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1389782	1389783			
Sample Reference				TP125	WS110			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				05/12/2019	05/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	18	-			
Barium (aqua regia extractable)	mg/kg	1	MCERTS	250	-			
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.0	-			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	-			
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	-			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	110	-			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	230	-			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.9	-			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	23	-			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-			
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	28	-			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	200	-			

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1389782	1389783			
Sample Reference				TP125	WS110			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				05/12/2019	05/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	-	-			
Toluene	µg/kg	1	MCERTS	-	-			
Ethylbenzene	µg/kg	1	MCERTS	-	-			
p & m-xylene	µg/kg	1	MCERTS	-	-			
o-xylene	µg/kg	1	MCERTS	-	-			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-			
Petroleum Hydrocarbons								

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1389782	1389783			
Sample Reference				TP125	WS110			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				05/12/2019	05/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-			
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-			
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-			
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-			
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-			
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-			
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-			
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-			
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-			
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0			
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0			
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	8.2			
TPH (C16 - C21)	mg/kg	1	MCERTS	15	27			
TPH (C21 - C35)	mg/kg	1	MCERTS	27	44			
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10			
TPH Total C5 - C40	mg/kg	10	MCERTS	43	81			

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1389782	1389783			
Sample Reference				TP125	WS110			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				05/12/2019	05/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/kg	1	ISO 17025	-	-			
Chloroethane	µg/kg	1	NONE	-	-			
Bromomethane	µg/kg	1	ISO 17025	-	-			
Vinyl Chloride	µg/kg	1	NONE	-	-			
Trichlorofluoromethane	µg/kg	1	NONE	-	-			
1,1-Dichloroethene	µg/kg	1	NONE	-	-			
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	-	-			
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	-	-			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-			
1,1-Dichloroethane	µg/kg	1	MCERTS	-	-			
2,2-Dichloropropane	µg/kg	1	MCERTS	-	-			
Trichloromethane	µg/kg	1	MCERTS	-	-			
1,1,1-Trichloroethane	µg/kg	1	MCERTS	-	-			
1,2-Dichloroethane	µg/kg	1	MCERTS	-	-			
1,1-Dichloropropene	µg/kg	1	MCERTS	-	-			
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-			
Benzene	µg/kg	1	MCERTS	-	-			
Tetrachloromethane	µg/kg	1	MCERTS	-	-			
1,2-Dichloropropane	µg/kg	1	MCERTS	-	-			
Trichloroethene	µg/kg	1	MCERTS	-	-			
Dibromomethane	µg/kg	1	MCERTS	-	-			
Bromodichloromethane	µg/kg	1	MCERTS	-	-			
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-			
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	-	-			
Toluene	µg/kg	1	MCERTS	-	-			
1,1,2-Trichloroethane	µg/kg	1	MCERTS	-	-			
1,3-Dichloropropane	µg/kg	1	ISO 17025	-	-			
Dibromochloromethane	µg/kg	1	ISO 17025	-	-			
Tetrachloroethene	µg/kg	1	NONE	-	-			
1,2-Dibromoethane	µg/kg	1	ISO 17025	-	-			
Chlorobenzene	µg/kg	1	MCERTS	-	-			
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-			
Ethylbenzene	µg/kg	1	MCERTS	-	-			
p & m-Xylene	µg/kg	1	MCERTS	-	-			
Styrene	µg/kg	1	MCERTS	-	-			
Tribromomethane	µg/kg	1	NONE	-	-			
o-Xylene	µg/kg	1	MCERTS	-	-			
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	-	-			
Isopropylbenzene	µg/kg	1	MCERTS	-	-			
Bromobenzene	µg/kg	1	MCERTS	-	-			
n-Propylbenzene	µg/kg	1	ISO 17025	-	-			
2-Chlorotoluene	µg/kg	1	MCERTS	-	-			
4-Chlorotoluene	µg/kg	1	MCERTS	-	-			
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	-	-			
tert-Butylbenzene	µg/kg	1	MCERTS	-	-			
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	-	-			
sec-Butylbenzene	µg/kg	1	MCERTS	-	-			
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	-	-			
p-Isopropyltoluene	µg/kg	1	ISO 17025	-	-			
1,2-Dichlorobenzene	µg/kg	1	MCERTS	-	-			
1,4-Dichlorobenzene	µg/kg	1	MCERTS	-	-			
Butylbenzene	µg/kg	1	MCERTS	-	-			
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	-	-			
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	-	-			
Hexachlorobutadiene	µg/kg	1	MCERTS	-	-			
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	-	-			

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1389782	1389783			
Sample Reference				TP125	WS110			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				05/12/2019	05/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	-	-			
Phenol	mg/kg	0.2	ISO 17025	-	-			
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-			
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-			
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-			
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-			
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-			
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-			
2-Methylphenol	mg/kg	0.3	MCERTS	-	-			
Hexachloroethane	mg/kg	0.05	MCERTS	-	-			
Nitrobenzene	mg/kg	0.3	MCERTS	-	-			
4-Methylphenol	mg/kg	0.2	NONE	-	-			
Isophorone	mg/kg	0.2	MCERTS	-	-			
2-Nitrophenol	mg/kg	0.3	MCERTS	-	-			
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-			
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-			
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-			
Naphthalene	mg/kg	0.05	MCERTS	-	-			
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-			
4-Chloroaniline	mg/kg	0.1	NONE	-	-			
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-			
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-			
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	-	-			
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	-	-			
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-			
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-			
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-			
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	-	-			
Acenaphthylene	mg/kg	0.05	MCERTS	-	-			
Acenaphthene	mg/kg	0.05	MCERTS	-	-			
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	-	-			
Dibenzofuran	mg/kg	0.2	MCERTS	-	-			
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	-	-			
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-			
4-Nitroaniline	mg/kg	0.2	MCERTS	-	-			
Fluorene	mg/kg	0.05	MCERTS	-	-			
Azobenzene	mg/kg	0.3	MCERTS	-	-			
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-			
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-			
Phenanthrene	mg/kg	0.05	MCERTS	-	-			
Anthracene	mg/kg	0.05	MCERTS	-	-			
Carbazole	mg/kg	0.3	MCERTS	-	-			
Dibutyl phthalate	mg/kg	0.2	MCERTS	-	-			
Anthraquinone	mg/kg	0.3	MCERTS	-	-			
Fluoranthene	mg/kg	0.05	MCERTS	-	-			
Pyrene	mg/kg	0.05	MCERTS	-	-			
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	-	-			
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-			
Chrysene	mg/kg	0.05	MCERTS	-	-			
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-			
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-			
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-			
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-			
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-			

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Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton
Your Order No: 34146

Lab Sample Number				1389782	1389783			
Sample Reference				TP125	WS110			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.10	0.50			
Date Sampled				05/12/2019	05/12/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					

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Analytical Report : **Combine Report Ryebank Chorlton**
Project / Site name: **Ryebank Chorlton**
Your Order No: **34146**

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006 based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
1386191	WS101	1.80	80	Loose Fibrous Debris	**Chrysotile & Amosite**	1.183	**1.18**
1386192	WS102	3.20	120	Bitumen	**Chrysotile**	0.036	**0.036**
1386194	WS112	2.30	133	Hard/ Cement Type Material	**Chrysotile**	0.014	**0.014**
1389783	WS110	0.50	118	Loose Fibres	**Chrysotile**	< 0.001	**< 0.001**

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

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Analytical Report : Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton

Your Order No: 34146

Lab Sample Number				1386195	1386196	1386197	1386198	
Sample Reference				TP103	TP106	WS106	WS111	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				2.10	1.50	0.80	2.70	
Date Sampled				04/12/2019	04/12/2019	04/12/2019	05/12/2019	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH	pH Units	N/A	ISO 17025	12.6	8.2	8.3	12.6	
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	7.4	< 1.0	1.5	5.2	
Total Phenols								
Total Phenols (monohydric)	µg/l	1	ISO 17025	22	4.6	2.0	8.9	
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Total PAH								
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	
Heavy Metals / Metalloids								
Arsenic (dissolved)	µg/l	1.1	ISO 17025	12	5.5	2.0	4.4	
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	20	< 5.0	< 5.0	
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.5	0.7	3.1	0.6	
Copper (dissolved)	µg/l	0.7	ISO 17025	14	110	9.0	13	
Lead (dissolved)	µg/l	1	ISO 17025	1.5	9.8	26	< 1.0	
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	
Nickel (dissolved)	µg/l	0.3	ISO 17025	11	7.1	2.0	5.3	
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	< 4.0	
Zinc (dissolved)	µg/l	0.4	ISO 17025	6.4	73	13	2.7	

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Analytical Report : Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton

Your Order No: 34146

Lab Sample Number				1386195	1386196	1386197	1386198	
Sample Reference				TP103	TP106	WS106	WS111	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				2.10	1.50	0.80	2.70	
Date Sampled				04/12/2019	04/12/2019	04/12/2019	05/12/2019	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10	< 10	< 10	< 10	
Petroleum Hydrocarbons								
TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	

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Analytical Report : Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1386182	TP103	None Supplied	1.30	Brown loam and sand with gravel.
1386183	TP105	None Supplied	0.10	Brown clay and sand with vegetation.
1386184	TP111	None Supplied	1.20	Grey clay.
1386186	TP115	None Supplied	1.60	Grey clay.
1386187	TP116	None Supplied	1.50	Brown clay and sand with gravel.
1386189	TP127	None Supplied	1.80	Brown clay and sand with gravel.
1386190	TP128	None Supplied	0.80	Brown sand with gravel and clinker
1386191	WS101	None Supplied	1.80	Brown clay and sand.
1386192	WS102	None Supplied	3.20	Brown sand with clinker.
1386193	WS105	None Supplied	3.80	Grey clay.
1386194	WS112	None Supplied	2.30	Brown sand with clinker.
1389778	TP101	None Supplied	0.10	Brown loam and clay with vegetation.
1389779	TP113	None Supplied	0.10	Brown loam with vegetation.
1389780	TP119	None Supplied	0.10	Brown loam and sand with gravel.
1389781	TP120	None Supplied	2.10	Brown clay and sand with clinker.
1389782	TP125	None Supplied	0.10	Brown loam and clay with vegetation.
1389783	WS110	None Supplied	0.50	Brown sand with clinker.

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Analytical Report : Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE

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Analytical Report : Combine Report Ryebank Chorlton

Project / Site name: Ryebank Chorlton

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	In-house method	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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Analytical Report Number : 19-78337

Project / Site name:	Ryebank	**Samples received on:**	17/12/2019
Your job number:	13533	**Samples instructed on:**	18/12/2019
Your order number:	34269	**Analysis completed by:**	30/12/2019
Report Issue Number:	1	**Report issued on:**	30/12/2019
Samples Analysed:	4 water samples		

Signed: A. Czerwińska

Agnieszka Czerwińska

Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

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Analytical Report Number: 19-78337

Project / Site name: Ryebank

Your Order No: 34269

Lab Sample Number				1397016	1397017	1397018	1397019	
Sample Reference				WS101	WS110	CP101	CP102	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	
Date Sampled				16/12/2019	16/12/2019	16/12/2019	16/12/2019	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH	pH Units	N/A	ISO 17025	7.2	7.8	11.1	10.7	
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	5.2	31	160	81	
Total Phenols								
Total Phenols (monohydric)	µg/l	1	ISO 17025	5.1	34	190	310	
Heavy Metals / Metalloids								
Arsenic (dissolved)	µg/l	0.15	ISO 17025	3.63	15.4	12.8	14.0	
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.03	0.06	0.04	0.03	
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	< 5.0	
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.7	0.9	5.7	1.3	
Copper (dissolved)	µg/l	0.5	ISO 17025	4.3	9.1	7.5	5.0	
Lead (dissolved)	µg/l	0.2	ISO 17025	0.4	16	4.4	9.5	
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	0.18	0.17	
Nickel (dissolved)	µg/l	0.5	ISO 17025	4.7	22	6.4	15	
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.4	3.1	5.3	3.8	
Zinc (dissolved)	µg/l	0.5	ISO 17025	14	48	62	34	
Monoaromatics & Oxygenates								
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	11.3	7.0	
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	4.6	4.4	
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	1.8	1.6	
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	4.3	5.3	
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	3.3	3.1	
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Petroleum Hydrocarbons								
TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	360	150	
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	11	7.0	
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	4.6	4.4	
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	11	12	
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	63	48	
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	220	63	
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	79	41	
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	390	180	

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Analytical Report Number: 19-78337

Project / Site name: Ryebank

Your Order No: 34269

Lab Sample Number				1397016	1397017	1397018	1397019	
Sample Reference				WS101	WS110	CP101	CP102	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	
Date Sampled				16/12/2019	16/12/2019	16/12/2019	16/12/2019	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
VOCs								
Chloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Chloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Bromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Vinyl Chloride	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	
Trichlorofluoromethane	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	
1,1-Dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
2,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Trichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	9.1	< 1.0	
1,1,1-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1-Dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	11.3	7.0	
Tetrachloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Trichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Dibromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Bromodichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	4.6	4.4	
1,1,2-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,3-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Dibromochloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Tetrachloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dibromoethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Chlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	1.8	1.6	
p & m-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	4.3	5.3	
Styrene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Tribromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
o-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	3.3	3.1	
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Isopropylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Bromobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
n-Propylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
2-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
4-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
tert-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	1.9	1.7	
sec-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,3-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
p-Isopropyltoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,4-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Hexachlorobutadiene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	

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Analytical Report Number: 19-78337

Project / Site name: Ryebank

Your Order No: 34269

Lab Sample Number				1397016	1397017	1397018	1397019	
Sample Reference				WS101	WS110	CP101	CP102	
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	
Date Sampled				16/12/2019	16/12/2019	16/12/2019	16/12/2019	
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	µg/l	0.05	NONE	< 0.05	4.5	9.7	10	
Phenol	µg/l	0.05	NONE	< 0.05	< 0.05	6.0	17	
2-Chlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
1,3-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
1,2-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	17	39	
Hexachloroethane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Nitrobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
4-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	26	55	
Isophorone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2-Nitrophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05	2.0	38	76	
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	16	3.4	
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
4-Chloroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Dimethylphthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	0.50	< 0.01	
Acenaphthene	µg/l	0.01	ISO 17025	5.2	< 0.01	0.35	< 0.01	
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Dibenzofuran	µg/l	0.05	NONE	0.97	< 0.05	< 0.05	< 0.05	
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Diethyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
4-Nitroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Fluorene	µg/l	0.01	ISO 17025	2.0	< 0.01	< 0.01	< 0.01	
Azobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Phenanthrene	µg/l	0.01	ISO 17025	1.0	< 0.01	< 0.01	< 0.01	
Anthracene	µg/l	0.01	ISO 17025	0.25	< 0.01	< 0.01	< 0.01	
Carbazole	µg/l	0.05	NONE	< 0.05	< 0.05	3.2	1.7	
Dibutyl phthalate	µg/l	0.05	NONE	< 0.05	6.9	20	5.8	
Anthraquinone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	1.8	
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	

U/S = Unsuitable Sample I/S = Insufficient Sample

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 19-78337

Project / Site name: Ryebank

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Low level total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Monohydric phenols in water - LOW LEVEL 1 ug/l	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	W	ISO 17025
Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds in leachate by extraction in dichloromethane followed by GC-MS.	In-house method based on USEPA 8270	L102B-PL	W	NONE
TPH1 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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The results included within the report are representative of the samples submitted for analysis.

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Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	24-22675-1
Initial Date of Issue:	25-Jul-2024
Re-Issue Details:	
Client	E3P
Client Address:	Taylor Road Trafford Park Urmston Manchester M41 7JQ
Contact(s):	Rebecca Hodnett
Project	17-403 Rybank Fields

Quotation No.:		**Date Received:**	17-Jul-2024
Order No.:		**Date Instructed:**	17-Jul-2024
No. of Samples:	23		
Turnaround (Wkdays):	5	**Results Due:**	23-Jul-2024
Date Approved:	25-Jul-2024		

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836712	1836728
				Client Sample ID.:		WS202	CP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		1.30	4.00
				Date Sampled:		09-Jul-2024	09-Jul-2024
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
pH at 20C	U	1010	2:1		4.0	7.8	8.2
Cyanide (Total)	U	1300	2:1	mg/l	0.050	< 0.050	< 0.050
Arsenic (Dissolved)	U	1455	2:1	µg/l	0.20	5.2	10
Cadmium (Dissolved)	U	1455	2:1	µg/l	0.11	< 0.11	< 0.11
Chromium (Dissolved)	U	1455	2:1	µg/l	0.50	0.56	0.55
Copper (Dissolved)	U	1455	2:1	µg/l	0.50	0.63	5.6
Mercury (Dissolved)	U	1455	2:1	µg/l	0.05	< 0.05	< 0.05
Nickel (Dissolved)	U	1455	2:1	µg/l	0.50	19	< 0.50
Lead (Dissolved)	U	1455	2:1	µg/l	0.50	< 0.50	0.89
Selenium (Dissolved)	U	1455	2:1	µg/l	0.50	< 0.50	< 0.50
Zinc (Dissolved)	U	1455	2:1	µg/l	2.5	3.7	2.5
Chromium (Hexavalent)	U	1490	2:1	µg/l	20	< 20	< 20
C2 Aliphatic TPH >C5-C6	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C6-C8	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C8-C10	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C10-C12	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C12-C16	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C16-C21	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C21-C35	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C35-C44	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	2:1	µg/l	5.0	< 5.0	< 5.0
C2 Aromatic TPH >C5-C7	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aromatic TPH >C7-C8	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aromatic TPH >C8-C10	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aromatic TPH >C10-C12	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aromatic TPH >C12-C16	N	1675	2:1	µg/l	0.10	< 0.10	45
C2 Aromatic TPH >C16-C21	N	1675	2:1	µg/l	0.10	< 0.10	66
C2 Aromatic TPH >C21-C35	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Aromatic TPH >C35-C44	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10
C2 Total Aromatic Hydrocarbons	N	1675	2:1	µg/l	5.0	< 5.0	110
Total Petroleum Hydrocarbons	N	1675	2:1	µg/l	10	< 10	110
Benzene	U	1760	2:1	µg/l	1.0	< 1.0	< 1.0
Toluene	U	1760	2:1	µg/l	1.0	< 1.0	< 1.0
Ethylbenzene	U	1760	2:1	µg/l	1.0	< 1.0	< 1.0
m & p-Xylene	U	1760	2:1	µg/l	1.0	< 1.0	< 1.0
o-Xylene	U	1760	2:1	µg/l	1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	N	1760	2:1	µg/l	1.0	< 1.0	< 1.0
Naphthalene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Acenaphthylene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Acenaphthene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010

Results - Leachate

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836712	1836728
				Client Sample ID.:		WS202	CP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		1.30	4.00
				Date Sampled:		09-Jul-2024	09-Jul-2024
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**		
Fluorene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Phenanthrene	N	1800	2:1	µg/l	0.010	< 0.010	12
Anthracene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Fluoranthene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Pyrene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Benzo[a]anthracene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Chrysene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	1800	2:1	µg/l	0.010	< 0.010	< 0.010
Total Of 16 PAH's	N	1800	2:1	µg/l	0.20	< 0.20	12
Total Phenols	U	1920	2:1	mg/l	0.030	< 0.030	< 0.030

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836706	1836707	1836708	1836709	1836710	1836711	1836713
				Client Sample ID.:		TP201	TP202	TP202	WS201	WS201	WS202	WS202
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		2.00	0.10	1.00	0.40	2.80	0.10	3.00
				Date Sampled:		08-Jul-2024	08-Jul-2024	08-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
ACM Type		U	2192		N/A	-	-	-	-	Fibres/Clumps	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	Chrysotile	No Asbestos Detected	No Asbestos Detected
Asbestos by Gravimetry		U	2192	%	0.001					0.70		
Total Asbestos		U	2192	%	0.001					0.70		
Moisture		N	2030	%	0.020	37	31	16	17	23	24	26
Soil Colour		N	2040		N/A	Grey	Brown	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Stones and Roots	Stones and Roots	Stones and Roots	Stones, Roots and Glass	Stones and Roots	Stones and Roots
Soil Texture		N	2040		N/A	Loam	Clay	Loam	Loam	Loam	Loam	Loam
pH at 20C		M	2010		4.0	11.6	9.1	11.5	9.6	11.7	6.9	8.9
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.77	0.047	0.36	0.035	0.64	0.033	0.80
Total Sulphur		U	2175	%	0.010	1.1	0.22	0.15	0.049	0.27	0.049	0.71
Cyanide (Total)		M	2300	mg/kg	0.50	1.1	0.60	< 0.50	< 0.50	0.90	< 0.50	73
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	110	14	10	25	4.0	5.8	21
Sulphate (Total)		U	2430	%	0.010	0.68	0.14	0.23	0.075	0.52	0.11	1.4
Arsenic		M	2455	mg/kg	0.5	11	7.9	17	12	40	9.9	150
Cadmium		M	2455	mg/kg	0.10	1.1	0.30	0.21	0.28	0.62	0.15	0.68
Chromium		M	2455	mg/kg	0.5	14	20	22	18	33	12	34
Copper		M	2455	mg/kg	0.50	440	80	110	56	260	59	450
Mercury		M	2455	mg/kg	0.05	0.71	0.59	0.23	0.62	0.52	0.37	1.2
Nickel		M	2455	mg/kg	0.50	17	16	30	22	62	10	33
Lead		M	2455	mg/kg	0.50	510	250	280	130	950	140	1700
Selenium		M	2455	mg/kg	0.25	0.48	0.48	0.52	0.61	1.4	0.33	0.92
Zinc		M	2455	mg/kg	0.50	560	150	270	170	580	120	310
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05							< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05							< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05							< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10							< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05							3.5
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25							3.5
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00							120
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00							87
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00							980
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00							2800
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00							210
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00							4000

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836706	1836707	1836708	1836709	1836710	1836711	1836713
				Client Sample ID.:		TP201	TP202	TP202	WS201	WS201	WS202	WS202
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		2.00	0.10	1.00	0.40	2.80	0.10	3.00
				Date Sampled:		08-Jul-2024	08-Jul-2024	08-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00							4200
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05							< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05							< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05							< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25							< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00							57
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00							79
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00							430
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00							9.7
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00							38
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00							580
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00							610
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50							3.5
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00							4600
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00							4800
Organic Matter		M	2625	%	0.40		13	13	3.9	11	14	
Total Organic Carbon		M	2625	%	0.20	2.2	7.7	7.6	2.3	6.6	8.4	12
TPH >C6-C8	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
TPH >C8-C10	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	53	< 1.0	
TPH >C10-C12	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	38	< 1.0	
TPH >C12-C16	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	27	20	180	16	
TPH >C16-C21	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	35	23	1100	30	
TPH >C21-C25	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	20	18	820	16	
TPH >C25-C35	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	67	51	1000	76	5600
TPH >C35-C40	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	12	7.0	220	13	590
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10	< 10	< 10	160	120	3400	150	12000
Dichlorodifluoromethane		U	2760	µg/kg	1.0	< 1.0						< 1.0
Chloromethane		M	2760	µg/kg	1.0	< 1.0						< 1.0
Vinyl Chloride		M	2760	µg/kg	1.0	< 1.0						< 1.0
Bromomethane		M	2760	µg/kg	20	< 20						< 20
Chloroethane		U	2760	µg/kg	2.0	< 2.0						< 2.0
Trichlorofluoromethane		M	2760	µg/kg	1.0	< 1.0						< 1.0
1,1-Dichloroethene		M	2760	µg/kg	1.0	< 1.0						< 1.0
Dichloromethane		N	2760	µg/kg	50	< 50						< 50
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0						< 1.0
1,1-Dichloroethane		M	2760	µg/kg	1.0	< 1.0						< 1.0
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0						< 1.0
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0						< 5.0
Trichloromethane		M	2760	µg/kg	1.0	< 1.0						< 1.0

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836706	1836707	1836708	1836709	1836710	1836711	1836713
				Client Sample ID.:		TP201	TP202	TP202	WS201	WS201	WS202	WS202
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		2.00	0.10	1.00	0.40	2.80	0.10	3.00
				Date Sampled:		08-Jul-2024	08-Jul-2024	08-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
1,1,1-Trichloroethane		M	2760	µg/kg	1.0	< 1.0						< 1.0
Tetrachloromethane		M	2760	µg/kg	1.0	< 1.0						< 1.0
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0						< 1.0
Benzene		M	2760	µg/kg	1.0	4.3						6.6
1,2-Dichloroethane		M	2760	µg/kg	2.0	< 2.0						< 2.0
Trichloroethene		N	2760	µg/kg	1.0	< 1.0						< 1.0
1,2-Dichloropropane		M	2760	µg/kg	1.0	< 1.0						< 1.0
Dibromomethane		M	2760	µg/kg	1.0	< 1.0						< 1.0
Bromodichloromethane		M	2760	µg/kg	5.0	< 5.0						< 5.0
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10						< 10
Toluene		M	2760	µg/kg	1.0	< 1.0						< 1.0
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10						< 10
1,1,2-Trichloroethane		M	2760	µg/kg	10	< 10						< 10
Tetrachloroethene		M	2760	µg/kg	1.0	< 1.0						< 1.0
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0						< 2.0
Dibromochloromethane		U	2760	µg/kg	10	< 10						< 10
1,2-Dibromoethane		M	2760	µg/kg	5.0	< 5.0						< 5.0
Chlorobenzene		M	2760	µg/kg	1.0	< 1.0						< 1.0
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0	< 2.0						< 2.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0						< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0						< 1.0
o-Xylene		M	2760	µg/kg	1.0	< 1.0						< 1.0
Styrene		M	2760	µg/kg	1.0	< 1.0						< 1.0
Tribromomethane		U	2760	µg/kg	1.0	< 1.0						< 1.0
Isopropylbenzene		M	2760	µg/kg	1.0	< 1.0						< 1.0
Bromobenzene		M	2760	µg/kg	1.0	< 1.0						< 1.0
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50						< 50
N-Propylbenzene		U	2760	µg/kg	1.0	< 1.0						< 1.0
2-Chlorotoluene		M	2760	µg/kg	1.0	< 1.0						< 1.0
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0						< 1.0
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0						< 1.0
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0						< 1.0
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0	< 1.0						30
Sec-Butylbenzene		U	2760	µg/kg	1.0	< 1.0						< 1.0
1,3-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0						< 1.0
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0						< 1.0
1,4-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0						< 1.0
N-Butylbenzene		U	2760	µg/kg	1.0	< 1.0						< 1.0
1,2-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0						< 1.0

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836706	1836707	1836708	1836709	1836710	1836711	1836713
				Client Sample ID.:		TP201	TP202	TP202	WS201	WS201	WS202	WS202
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		2.00	0.10	1.00	0.40	2.80	0.10	3.00
				Date Sampled:		08-Jul-2024	08-Jul-2024	08-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
1,2-Dibromo-3-Chloropropane		U	2760	µg/kg	50	< 50						< 50
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0	< 1.0						< 1.0
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0						< 1.0
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	< 2.0						< 2.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0						< 1.0
N-Nitrosodimethylamine		M	2790	mg/kg	0.50	< 0.50						< 0.50
Phenol		M	2790	mg/kg	0.50	< 0.50						< 0.50
2-Chlorophenol		N	2790	mg/kg	0.50	< 0.50						< 0.50
Bis-(2-Chloroethyl)Ether		M	2790	mg/kg	0.50	< 0.50						< 0.50
1,3-Dichlorobenzene		M	2790	mg/kg	0.50	< 0.50						< 0.50
1,4-Dichlorobenzene		N	2790	mg/kg	0.50	< 0.50						< 0.50
1,2-Dichlorobenzene		M	2790	mg/kg	0.50	< 0.50						< 0.50
2-Methylphenol		M	2790	mg/kg	0.50	< 0.50						< 0.50
Bis(2-Chloroisopropyl)Ether		M	2790	mg/kg	0.50	< 0.50						< 0.50
Hexachloroethane		N	2790	mg/kg	0.50	< 0.50						< 0.50
N-Nitrosodi-n-propylamine		M	2790	mg/kg	0.50	< 0.50						< 0.50
4-Methylphenol		M	2790	mg/kg	0.50	< 0.50						< 0.50
Nitrobenzene		N	2790	mg/kg	0.50	< 0.50						< 0.50
Isophorone		M	2790	mg/kg	0.50	< 0.50						< 0.50
2-Nitrophenol		N	2790	mg/kg	0.50	< 0.50						< 0.50
2,4-Dimethylphenol		N	2790	mg/kg	0.50	< 0.50						< 0.50
Bis(2-Chloroethoxy)Methane		M	2790	mg/kg	0.50	< 0.50						< 0.50
2,4-Dichlorophenol		N	2790	mg/kg	0.50	< 0.50						< 0.50
1,2,4-Trichlorobenzene		M	2790	mg/kg	0.50	< 0.50						< 0.50
Naphthalene		M	2790	mg/kg	0.50	< 0.50						< 0.50
4-Chloroaniline		N	2790	mg/kg	0.50	< 0.50						< 0.50
Hexachlorobutadiene		M	2790	mg/kg	0.50	< 0.50						< 0.50
4-Chloro-3-Methylphenol		N	2790	mg/kg	0.50	< 0.50						< 0.50
2-Methylnaphthalene		M	2790	mg/kg	0.50	< 0.50						< 0.50
4-Nitrophenol		N	2790	mg/kg	0.50	< 0.50						< 0.50
2,4,6-Trichlorophenol		N	2790	mg/kg	0.50	< 0.50						< 0.50
2,4,5-Trichlorophenol		N	2790	mg/kg	0.50	< 0.50						< 0.50
2-Chloronaphthalene		M	2790	mg/kg	0.50	< 0.50						< 0.50
2-Nitroaniline		N	2790	mg/kg	0.50	< 0.50						< 0.50
Acenaphthylene		M	2790	mg/kg	0.50	< 0.50						< 0.50
Dimethylphthalate		M	2790	mg/kg	0.50	< 0.50						< 0.50
2,6-Dinitrotoluene		N	2790	mg/kg	0.50	< 0.50						< 0.50
Acenaphthene		M	2790	mg/kg	0.50	< 0.50						8.5
3-Nitroaniline		N	2790	mg/kg	0.50	< 0.50						< 0.50

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836706	1836707	1836708	1836709	1836710	1836711	1836713
				Client Sample ID.:		TP201	TP202	TP202	WS201	WS201	WS202	WS202
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		2.00	0.10	1.00	0.40	2.80	0.10	3.00
				Date Sampled:		08-Jul-2024	08-Jul-2024	08-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Dibenzofuran		M	2790	mg/kg	0.50	< 0.50						< 0.50
4-Chlorophenylphenylether		M	2790	mg/kg	0.50	< 0.50						< 0.50
2,4-Dinitrotoluene		N	2790	mg/kg	0.50	< 0.50						< 0.50
Fluorene		M	2790	mg/kg	0.50	< 0.50						2.9
Diethyl Phthalate		M	2790	mg/kg	0.50	< 0.50						< 0.50
4-Nitroaniline		N	2790	mg/kg	0.50	< 0.50						< 0.50
Azobenzene		M	2790	mg/kg	0.50	< 0.50						< 0.50
4-Bromophenylphenyl Ether		M	2790	mg/kg	0.50	< 0.50						< 0.50
Hexachlorobenzene		M	2790	mg/kg	0.50	< 0.50						< 0.50
Phenanthrene		M	2790	mg/kg	0.50	< 0.50						3.3
Anthracene		M	2790	mg/kg	0.50	< 0.50						1.5
Carbazole		M	2790	mg/kg	0.50	< 0.50						< 0.50
Di-N-Butyl Phthalate		N	2790	mg/kg	0.50	< 0.50						< 0.50
Fluoranthene		M	2790	mg/kg	0.50	< 0.50						8.8
Pyrene		M	2790	mg/kg	0.50	< 0.50						7.9
Butylbenzyl Phthalate		N	2790	mg/kg	0.50	< 0.50						< 0.50
Benzo[a]anthracene		M	2790	mg/kg	0.50	< 0.50						3.0
Chrysene		M	2790	mg/kg	0.50	< 0.50						3.5
Bis(2-Ethylhexyl)Phthalate		N	2790	mg/kg	0.50	< 0.50						< 0.50
Di-N-Octyl Phthalate		N	2790	mg/kg	0.50	< 0.50						< 0.50
Benzo[b]fluoranthene		M	2790	mg/kg	0.50	< 0.50						3.8
Benzo[k]fluoranthene		M	2790	mg/kg	0.50	< 0.50						1.2
Benzo[a]pyrene		M	2790	mg/kg	0.50	< 0.50						2.9
Indeno(1,2,3-c,d)Pyrene		N	2790	mg/kg	0.50	< 0.50						1.6
Dibenz(a,h)Anthracene		N	2790	mg/kg	0.50	< 0.50						< 0.50
Benzo[g,h,i]perylene		M	2790	mg/kg	0.50	< 0.50						1.9
Naphthalene		M	2800	mg/kg	0.10		0.39	0.51	1.1	0.71	< 0.10	
Acenaphthylene		N	2800	mg/kg	0.10		< 0.10	0.67	< 0.10	< 0.10	< 0.10	
Acenaphthene		M	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
Fluorene		M	2800	mg/kg	0.10		< 0.10	< 0.10	0.48	< 0.10	< 0.10	
Phenanthrene		M	2800	mg/kg	0.10		1.5	32	3.2	12	0.70	
Anthracene		M	2800	mg/kg	0.10		0.32	8.7	0.87	3.0	0.18	
Fluoranthene		M	2800	mg/kg	0.10		2.7	27	3.1	13	1.4	
Pyrene		M	2800	mg/kg	0.10		2.6	19	2.8	11	1.3	
Benzo[a]anthracene		M	2800	mg/kg	0.10		1.3	11	1.2	5.2	0.76	
Chrysene		M	2800	mg/kg	0.10		1.4	9.4	1.2	4.9	0.81	
Benzo[b]fluoranthene		M	2800	mg/kg	0.10		2.1	12	1.7	7.1	1.2	
Benzo[k]fluoranthene		M	2800	mg/kg	0.10		0.60	4.4	0.55	2.4	0.40	
Benzo[a]pyrene		M	2800	mg/kg	0.10		1.5	9.7	1.2	5.4	0.95	

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836706	1836707	1836708	1836709	1836710	1836711	1836713
				Client Sample ID.:		TP201	TP202	TP202	WS201	WS201	WS202	WS202
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		2.00	0.10	1.00	0.40	2.80	0.10	3.00
				Date Sampled:		08-Jul-2024	08-Jul-2024	08-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024	09-Jul-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10		1.1	6.1	0.89	3.7	0.80	
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10		< 0.10	1.5	< 0.10	0.91	< 0.10	
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10		0.93	4.8	0.83	3.1	0.70	
Total Of 16 PAH's		N	2800	mg/kg	2.0		16	150	19	72	9.2	
PCB 28		U	2815	mg/kg	0.010	< 0.010						
PCB 52		U	2815	mg/kg	0.010	< 0.010						
PCB 101		U	2815	mg/kg	0.010	< 0.010						
PCB 118		U	2815	mg/kg	0.010	< 0.010						
PCB 153		U	2815	mg/kg	0.010	< 0.010						
PCB 138		U	2815	mg/kg	0.010	< 0.010						
PCB 180		U	2815	mg/kg	0.010	< 0.010						
Total PCBs (7 Congeners)		N	2815	mg/kg	0.10	< 0.10						
Total Phenols		M	2920	mg/kg	0.10	0.11	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.42

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836714	1836715	1836717	1836718	1836719	1836721	1836722	1836725
				Client Sample ID.:		WS203	WS203	WS204	WS204	WS205	WS205	WS206	WS207
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		1.00	2.50	1.70	3.50	1.00	2.00	0.80	2.80
				Date Sampled:		10-Jul-2024	10-Jul-2024	10-Jul-2024	10-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024
				Asbestos Lab:		NEW-ASB		NEW-ASB	NEW-ASB		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**								
ACM Type		U	2192		N/A	-		-	-		-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Asbestos by Gravimetry		U	2192	%	0.001								
Total Asbestos		U	2192	%	0.001								
Moisture		N	2030	%	0.020	8.6	23	24	25	17	19	18	35
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Black	Brown	Brown	Brown	Grey
Other Material		N	2040		N/A	Stones	Stones and Roots	Stones	Stones	Stones and Roots	Stones	Stones and Roots	Stones and Roots
Soil Texture		N	2040		N/A	Sand	Clay	Loam	Loam	Loam	Loam	Clay	Loam
pH at 20C		M	2010		4.0	7.9	11.5	8.5	7.7		10.5	8.8	11.7
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.077	1.0	0.10	0.31		1.8	0.023	0.85
Total Sulphur		U	2175	%	0.010	0.026	0.20	0.34	1.8		0.43	0.070	0.55
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50	1.5
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	28	3.9	9.0	200		4.3	25	54
Sulphate (Total)		U	2430	%	0.010	0.052	0.35	0.24	0.78		1.1	0.18	0.80
Arsenic		M	2455	mg/kg	0.5	7.1	5.7	77	27		15	20	1.3
Cadmium		M	2455	mg/kg	0.10	< 0.10	< 0.10	1.3	0.60		0.11	0.46	< 0.10
Chromium		M	2455	mg/kg	0.5	9.4	9.5	46	15		16	24	2.8
Copper		M	2455	mg/kg	0.50	10	11	500	260		41	110	39
Mercury		M	2455	mg/kg	0.05	0.05	0.08	0.07	2.7		0.16	0.42	0.07
Nickel		M	2455	mg/kg	0.50	9.6	11	110	24		15	26	6.1
Lead		M	2455	mg/kg	0.50	14	41	170	450		150	350	880
Selenium		M	2455	mg/kg	0.25	0.34	< 0.25	2.3	1.1		0.43	0.97	< 0.25
Zinc		M	2455	mg/kg	0.50	26	37	730	440		100	300	43
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05								
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05								
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05								
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10								
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05								
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25								
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00								
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00								
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00								
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00								
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00								
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00								

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836714	1836715	1836717	1836718	1836719	1836721	1836722	1836725
				Client Sample ID.:		WS203	WS203	WS204	WS204	WS205	WS205	WS206	WS207
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		1.00	2.50	1.70	3.50	1.00	2.00	0.80	2.80
				Date Sampled:		10-Jul-2024	10-Jul-2024	10-Jul-2024	10-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024
				Asbestos Lab:		NEW-ASB		NEW-ASB	NEW-ASB		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**								
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00								
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05								
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05								
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05								
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25								
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00								
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00								
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00								
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00								
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00								
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00								
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00								
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50								
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00								
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00								
Organic Matter		M	2625	%	0.40	0.90	1.8	43	3.8		2.3	12	3.5
Total Organic Carbon		M	2625	%	0.20	0.52	1.1	25	2.2		1.3	7.1	2.0
TPH >C6-C8	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0	2.6
TPH >C8-C10	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0		< 1.0	49		20	< 1.0	29
TPH >C10-C12	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0		< 1.0	110		15	3.7	20
TPH >C12-C16	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0		< 1.0	940		24	21	44
TPH >C16-C21	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0		< 1.0	10000		35	26	67
TPH >C21-C25	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0		< 1.0	17000		54	15	43
TPH >C25-C35	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0		< 1.0	33000		110	67	130
TPH >C35-C40	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0		< 1.0	5900		9.1	9.8	8.3
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10	< 10		< 10	67000		260	140	340
Dichlorodifluoromethane		U	2760	µg/kg	1.0								
Chloromethane		M	2760	µg/kg	1.0								
Vinyl Chloride		M	2760	µg/kg	1.0								
Bromomethane		M	2760	µg/kg	20								
Chloroethane		U	2760	µg/kg	2.0								
Trichlorofluoromethane		M	2760	µg/kg	1.0								
1,1-Dichloroethene		M	2760	µg/kg	1.0								
Dichloromethane		N	2760	µg/kg	50								
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0								
1,1-Dichloroethane		M	2760	µg/kg	1.0								
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0								
Bromochloromethane		U	2760	µg/kg	5.0								
Trichloromethane		M	2760	µg/kg	1.0								

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836714	1836715	1836717	1836718	1836719	1836721	1836722	1836725
				Client Sample ID.:		WS203	WS203	WS204	WS204	WS205	WS205	WS206	WS207
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		1.00	2.50	1.70	3.50	1.00	2.00	0.80	2.80
				Date Sampled:		10-Jul-2024	10-Jul-2024	10-Jul-2024	10-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024
				Asbestos Lab:		NEW-ASB		NEW-ASB	NEW-ASB		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**								
1,1,1-Trichloroethane		M	2760	µg/kg	1.0								
Tetrachloromethane		M	2760	µg/kg	1.0								
1,1-Dichloropropene		U	2760	µg/kg	1.0								
Benzene		M	2760	µg/kg	1.0								
1,2-Dichloroethane		M	2760	µg/kg	2.0								
Trichloroethene		N	2760	µg/kg	1.0								
1,2-Dichloropropane		M	2760	µg/kg	1.0								
Dibromomethane		M	2760	µg/kg	1.0								
Bromodichloromethane		M	2760	µg/kg	5.0								
cis-1,3-Dichloropropene		N	2760	µg/kg	10								
Toluene		M	2760	µg/kg	1.0								
Trans-1,3-Dichloropropene		N	2760	µg/kg	10								
1,1,2-Trichloroethane		M	2760	µg/kg	10								
Tetrachloroethene		M	2760	µg/kg	1.0								
1,3-Dichloropropane		U	2760	µg/kg	2.0								
Dibromochloromethane		U	2760	µg/kg	10								
1,2-Dibromoethane		M	2760	µg/kg	5.0								
Chlorobenzene		M	2760	µg/kg	1.0								
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0								
Ethylbenzene		M	2760	µg/kg	1.0								
m & p-Xylene		M	2760	µg/kg	1.0								
o-Xylene		M	2760	µg/kg	1.0								
Styrene		M	2760	µg/kg	1.0								
Tribromomethane		U	2760	µg/kg	1.0								
Isopropylbenzene		M	2760	µg/kg	1.0								
Bromobenzene		M	2760	µg/kg	1.0								
1,2,3-Trichloropropane		N	2760	µg/kg	50								
N-Propylbenzene		U	2760	µg/kg	1.0								
2-Chlorotoluene		M	2760	µg/kg	1.0								
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0								
4-Chlorotoluene		U	2760	µg/kg	1.0								
Tert-Butylbenzene		U	2760	µg/kg	1.0								
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0								
Sec-Butylbenzene		U	2760	µg/kg	1.0								
1,3-Dichlorobenzene		M	2760	µg/kg	1.0								
4-Isopropyltoluene		U	2760	µg/kg	1.0								
1,4-Dichlorobenzene		M	2760	µg/kg	1.0								
N-Butylbenzene		U	2760	µg/kg	1.0								
1,2-Dichlorobenzene		M	2760	µg/kg	1.0								

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836714	1836715	1836717	1836718	1836719	1836721	1836722	1836725
				Client Sample ID.:		WS203	WS203	WS204	WS204	WS205	WS205	WS206	WS207
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		1.00	2.50	1.70	3.50	1.00	2.00	0.80	2.80
				Date Sampled:		10-Jul-2024	10-Jul-2024	10-Jul-2024	10-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024
				Asbestos Lab:		NEW-ASB		NEW-ASB	NEW-ASB		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**								
1,2-Dibromo-3-Chloropropane		U	2760	µg/kg	50								
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0								
Hexachlorobutadiene		N	2760	µg/kg	1.0								
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0								
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0								
N-Nitrosodimethylamine		M	2790	mg/kg	0.50								
Phenol		M	2790	mg/kg	0.50								
2-Chlorophenol		N	2790	mg/kg	0.50								
Bis-(2-Chloroethyl)Ether		M	2790	mg/kg	0.50								
1,3-Dichlorobenzene		M	2790	mg/kg	0.50								
1,4-Dichlorobenzene		N	2790	mg/kg	0.50								
1,2-Dichlorobenzene		M	2790	mg/kg	0.50								
2-Methylphenol		M	2790	mg/kg	0.50								
Bis(2-Chloroisopropyl)Ether		M	2790	mg/kg	0.50								
Hexachloroethane		N	2790	mg/kg	0.50								
N-Nitrosodi-n-propylamine		M	2790	mg/kg	0.50								
4-Methylphenol		M	2790	mg/kg	0.50								
Nitrobenzene		N	2790	mg/kg	0.50								
Isophorone		M	2790	mg/kg	0.50								
2-Nitrophenol		N	2790	mg/kg	0.50								
2,4-Dimethylphenol		N	2790	mg/kg	0.50								
Bis(2-Chloroethoxy)Methane		M	2790	mg/kg	0.50								
2,4-Dichlorophenol		N	2790	mg/kg	0.50								
1,2,4-Trichlorobenzene		M	2790	mg/kg	0.50								
Naphthalene		M	2790	mg/kg	0.50								
4-Chloroaniline		N	2790	mg/kg	0.50								
Hexachlorobutadiene		M	2790	mg/kg	0.50								
4-Chloro-3-Methylphenol		N	2790	mg/kg	0.50								
2-Methylnaphthalene		M	2790	mg/kg	0.50								
4-Nitrophenol		N	2790	mg/kg	0.50								
2,4,6-Trichlorophenol		N	2790	mg/kg	0.50								
2,4,5-Trichlorophenol		N	2790	mg/kg	0.50								
2-Chloronaphthalene		M	2790	mg/kg	0.50								
2-Nitroaniline		N	2790	mg/kg	0.50								
Acenaphthylene		M	2790	mg/kg	0.50								
Dimethylphthalate		M	2790	mg/kg	0.50								
2,6-Dinitrotoluene		N	2790	mg/kg	0.50								
Acenaphthene		M	2790	mg/kg	0.50								
3-Nitroaniline		N	2790	mg/kg	0.50								

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836714	1836715	1836717	1836718	1836719	1836721	1836722	1836725
				Client Sample ID.:		WS203	WS203	WS204	WS204	WS205	WS205	WS206	WS207
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		1.00	2.50	1.70	3.50	1.00	2.00	0.80	2.80
				Date Sampled:		10-Jul-2024	10-Jul-2024	10-Jul-2024	10-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024
				Asbestos Lab:		NEW-ASB		NEW-ASB	NEW-ASB		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**								
Dibenzofuran		M	2790	mg/kg	0.50								
4-Chlorophenylphenylether		M	2790	mg/kg	0.50								
2,4-Dinitrotoluene		N	2790	mg/kg	0.50								
Fluorene		M	2790	mg/kg	0.50								
Diethyl Phthalate		M	2790	mg/kg	0.50								
4-Nitroaniline		N	2790	mg/kg	0.50								
Azobenzene		M	2790	mg/kg	0.50								
4-Bromophenylphenyl Ether		M	2790	mg/kg	0.50								
Hexachlorobenzene		M	2790	mg/kg	0.50								
Phenanthrene		M	2790	mg/kg	0.50								
Anthracene		M	2790	mg/kg	0.50								
Carbazole		M	2790	mg/kg	0.50								
Di-N-Butyl Phthalate		N	2790	mg/kg	0.50								
Fluoranthene		M	2790	mg/kg	0.50								
Pyrene		M	2790	mg/kg	0.50								
Butylbenzyl Phthalate		N	2790	mg/kg	0.50								
Benzo[a]anthracene		M	2790	mg/kg	0.50								
Chrysene		M	2790	mg/kg	0.50								
Bis(2-Ethylhexyl)Phthalate		N	2790	mg/kg	0.50								
Di-N-Octyl Phthalate		N	2790	mg/kg	0.50								
Benzo[b]fluoranthene		M	2790	mg/kg	0.50								
Benzo[k]fluoranthene		M	2790	mg/kg	0.50								
Benzo[a]pyrene		M	2790	mg/kg	0.50								
Indeno(1,2,3-c,d)Pyrene		N	2790	mg/kg	0.50								
Dibenz(a,h)Anthracene		N	2790	mg/kg	0.50								
Benzo[g,h,i]perylene		M	2790	mg/kg	0.50								
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	0.54	< 0.10		0.72	< 0.10	0.20
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	0.35
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	0.40
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	2.6	0.17	< 0.10		1.2	2.5	3.3
Anthracene		M	2800	mg/kg	0.10	< 0.10	0.80	< 0.10	2.9		0.27	0.60	0.74
Fluoranthene		M	2800	mg/kg	0.10	0.39	3.4	0.75	7.9		1.2	4.1	5.2
Pyrene		M	2800	mg/kg	0.10	0.41	3.0	0.70	7.6		1.1	3.6	4.2
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	1.5	0.20	< 0.10		0.51	1.8	1.9
Chrysene		M	2800	mg/kg	0.10	< 0.10	1.4	0.43	< 0.10		0.46	1.9	2.1
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	2.0	< 0.10	< 0.10		0.84	2.8	2.4
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	1.1	0.18	< 0.10		0.30	0.88	0.88
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	1.6	0.47	< 0.10		0.53	2.0	1.8

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836714	1836715	1836717	1836718	1836719	1836721	1836722	1836725
				Client Sample ID.:		WS203	WS203	WS204	WS204	WS205	WS205	WS206	WS207
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		1.00	2.50	1.70	3.50	1.00	2.00	0.80	2.80
				Date Sampled:		10-Jul-2024	10-Jul-2024	10-Jul-2024	10-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024	12-Jul-2024
				Asbestos Lab:		NEW-ASB		NEW-ASB	NEW-ASB		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**								
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	1.2	< 0.10	< 0.10		0.52	1.5	1.2
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	0.50	< 0.10	< 0.10		< 0.10	< 0.10	0.28
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	1.1	0.37	< 0.10		0.46	1.4	1.1
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	20	3.8	18		8.1	23	26
PCB 28		U	2815	mg/kg	0.010	< 0.010				< 0.010			
PCB 52		U	2815	mg/kg	0.010	< 0.010				< 0.010			
PCB 101		U	2815	mg/kg	0.010	< 0.010				< 0.010			
PCB 118		U	2815	mg/kg	0.010	< 0.010				< 0.010			
PCB 153		U	2815	mg/kg	0.010	< 0.010				< 0.010			
PCB 138		U	2815	mg/kg	0.010	< 0.010				< 0.010			
PCB 180		U	2815	mg/kg	0.010	< 0.010				< 0.010			
Total PCBs (7 Congeners)		N	2815	mg/kg	0.10	< 0.10				< 0.10			
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836726	1836727	1836729	1836730	1836731	1836732
				Client Sample ID.:		CP201	CP201	CP202	CP203	CP203	CP203
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		5.00	11.00	16.00	1.00	5.00	13.20
				Date Sampled:		09-Jul-2024	09-Jul-2024	09-Jul-2024	11-Jul-2024	11-Jul-2024	11-Jul-2024
				Asbestos Lab:		NEW-ASB			NEW-ASB	NEW-ASB	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
ACM Type		U	2192		N/A	Free Fibres			-	-	
Asbestos Identification		U	2192		N/A	Amosite Chrysotile Crocidolite			No Asbestos Detected	No Asbestos Detected	
Asbestos by Gravimetry		U	2192	%	0.001	0.65					
Total Asbestos		U	2192	%	0.001	0.65					
Moisture		N	2030	%	0.020	20	14	9.9	16	16	13
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones, Roots and	Stones and Roots	Stones	Stones and Roots	Stones, Roots and	Stones
Soil Texture		N	2040		N/A	Loam	Clay	Clay	Clay	Loam	Clay
pH at 20C		M	2010		4.0	8.6	9.3	8.7	8.1	9.6	8.4
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.28	0.089	0.014	0.28	0.98	0.099
Total Sulphur		U	2175	%	0.010	0.63	0.10	0.039	0.093	0.24	0.15
Cyanide (Total)		M	2300	mg/kg	0.50	1.7	< 0.50	< 0.50	0.50	1.3	1.2
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	8.0	9.6	6.1	8.9	83	4.9
Sulphate (Total)		U	2430	%	0.010	1.0	0.31	0.11	0.31	0.66	0.21
Arsenic		M	2455	mg/kg	0.5	15	< 0.5	< 0.5	8.4	13	21
Cadmium		M	2455	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.9	< 0.10
Chromium		M	2455	mg/kg	0.5	19	6.1	7.4	14	33	6.5
Copper		M	2455	mg/kg	0.50	860	18	6.7	60	1200	100
Mercury		M	2455	mg/kg	0.05	3.0	0.06	< 0.05	0.43	1.1	2.9
Nickel		M	2455	mg/kg	0.50	24	11	9.6	15	28	19
Lead		M	2455	mg/kg	0.50	610	21	1.5	190	750	310
Selenium		M	2455	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Zinc		M	2455	mg/kg	0.50	1400	72	27	130	460	150
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05				< 0.05	
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05				0.13	
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05				1.4	
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10				1.6	
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	1.3				35	
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	1.3				37	
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	18				90	
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	9.8				33	
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	22				28	
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	250				88	
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	70				19	
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	300				240	

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836726	1836727	1836729	1836730	1836731	1836732
				Client Sample ID.:		CP201	CP201	CP202	CP203	CP203	CP203
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		5.00	11.00	16.00	1.00	5.00	13.20
				Date Sampled:		09-Jul-2024	09-Jul-2024	09-Jul-2024	11-Jul-2024	11-Jul-2024	11-Jul-2024
				Asbestos Lab:		NEW-ASB			NEW-ASB	NEW-ASB	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	370				260	
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05				< 0.05	
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05				0.18	
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	0.83				7.6	
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	0.83				7.7	
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	22				50	
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	110				55	
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	420				110	
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	280				87	
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	44				14	
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	830				300	
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	870				320	
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	2.2				45	
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	1100				540	
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	1200				580	
Organic Matter		M	2625	%	0.40		2.7	1.2	10		10
Total Organic Carbon		M	2625	%	0.20	7.2	1.6	0.72	6.0	27	6.1
TPH >C6-C8	EH_1D_Total	N	2670	mg/kg	1.0		< 1.0	< 1.0	< 1.0		2.3
TPH >C8-C10	EH_1D_Total	N	2670	mg/kg	1.0		8.0	< 1.0	< 1.0		25
TPH >C10-C12	EH_1D_Total	N	2670	mg/kg	1.0		12	< 1.0	4.2		28
TPH >C12-C16	EH_1D_Total	N	2670	mg/kg	1.0		25	< 1.0	23		30
TPH >C16-C21	EH_1D_Total	N	2670	mg/kg	1.0		42	< 1.0	38		33
TPH >C21-C25	EH_1D_Total	N	2670	mg/kg	1.0		16	< 1.0	25		11
TPH >C25-C35	EH_1D_Total	N	2670	mg/kg	1.0		27	< 1.0	61		28
TPH >C35-C40	EH_1D_Total	N	2670	mg/kg	1.0		6.3	< 1.0	8.3		6.3
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10		140	< 10	160		160
Dichlorodifluoromethane		U	2760	µg/kg	1.0	< 1.0				< 1.0	
Chloromethane		M	2760	µg/kg	1.0	< 1.0				< 1.0	
Vinyl Chloride		M	2760	µg/kg	1.0	< 1.0				< 1.0	
Bromomethane		M	2760	µg/kg	20	< 20				< 20	
Chloroethane		U	2760	µg/kg	2.0	< 2.0				< 2.0	
Trichlorofluoromethane		M	2760	µg/kg	1.0	< 1.0				< 1.0	
1,1-Dichloroethene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
Dichloromethane		N	2760	µg/kg	50	< 50				< 50	
Trans 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
1,1-Dichloroethane		M	2760	µg/kg	1.0	< 1.0				< 1.0	
cis 1,2-Dichloroethene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
Bromochloromethane		U	2760	µg/kg	5.0	< 5.0				< 5.0	
Trichloromethane		M	2760	µg/kg	1.0	< 1.0				< 1.0	

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836726	1836727	1836729	1836730	1836731	1836732
				Client Sample ID.:		CP201	CP201	CP202	CP203	CP203	CP203
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		5.00	11.00	16.00	1.00	5.00	13.20
				Date Sampled:		09-Jul-2024	09-Jul-2024	09-Jul-2024	11-Jul-2024	11-Jul-2024	11-Jul-2024
				Asbestos Lab:		NEW-ASB			NEW-ASB	NEW-ASB	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
1,1,1-Trichloroethane		M	2760	µg/kg	1.0	< 1.0				< 1.0	
Tetrachloromethane		M	2760	µg/kg	1.0	< 1.0				< 1.0	
1,1-Dichloropropene		U	2760	µg/kg	1.0	< 1.0				< 1.0	
Benzene		M	2760	µg/kg	1.0	48				50	
1,2-Dichloroethane		M	2760	µg/kg	2.0	< 2.0				< 2.0	
Trichloroethene		N	2760	µg/kg	1.0	< 1.0				< 1.0	
1,2-Dichloropropane		M	2760	µg/kg	1.0	< 1.0				< 1.0	
Dibromomethane		M	2760	µg/kg	1.0	< 1.0				< 1.0	
Bromodichloromethane		M	2760	µg/kg	5.0	< 5.0				< 5.0	
cis-1,3-Dichloropropene		N	2760	µg/kg	10	< 10				< 10	
Toluene		M	2760	µg/kg	1.0	< 1.0				210	
Trans-1,3-Dichloropropene		N	2760	µg/kg	10	< 10				< 10	
1,1,2-Trichloroethane		M	2760	µg/kg	10	< 10				< 10	
Tetrachloroethene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
1,3-Dichloropropane		U	2760	µg/kg	2.0	< 2.0				< 2.0	
Dibromochloromethane		U	2760	µg/kg	10	< 10				< 10	
1,2-Dibromoethane		M	2760	µg/kg	5.0	< 5.0				< 5.0	
Chlorobenzene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
1,1,1,2-Tetrachloroethane		M	2760	µg/kg	2.0	< 2.0				< 2.0	
Ethylbenzene		M	2760	µg/kg	1.0	7.6				360	
m & p-Xylene		M	2760	µg/kg	1.0	19				1700	
o-Xylene		M	2760	µg/kg	1.0	21				970	
Styrene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
Tribromomethane		U	2760	µg/kg	1.0	< 1.0				< 1.0	
Isopropylbenzene		M	2760	µg/kg	1.0	73				250	
Bromobenzene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
1,2,3-Trichloropropane		N	2760	µg/kg	50	< 50				< 50	
N-Propylbenzene		U	2760	µg/kg	1.0	85				470	
2-Chlorotoluene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
1,3,5-Trimethylbenzene		M	2760	µg/kg	1.0	13				2200	
4-Chlorotoluene		U	2760	µg/kg	1.0	< 1.0				< 1.0	
Tert-Butylbenzene		U	2760	µg/kg	1.0	< 1.0				< 1.0	
1,2,4-Trimethylbenzene		M	2760	µg/kg	1.0	270				6500	
Sec-Butylbenzene		U	2760	µg/kg	1.0	30				210	
1,3-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
4-Isopropyltoluene		U	2760	µg/kg	1.0	< 1.0				370	
1,4-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
N-Butylbenzene		U	2760	µg/kg	1.0	25				< 1.0	
1,2-Dichlorobenzene		M	2760	µg/kg	1.0	< 1.0				< 1.0	

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836726	1836727	1836729	1836730	1836731	1836732
				Client Sample ID.:		CP201	CP201	CP202	CP203	CP203	CP203
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		5.00	11.00	16.00	1.00	5.00	13.20
				Date Sampled:		09-Jul-2024	09-Jul-2024	09-Jul-2024	11-Jul-2024	11-Jul-2024	11-Jul-2024
				Asbestos Lab:		NEW-ASB			NEW-ASB	NEW-ASB	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
1,2-Dibromo-3-Chloropropane		U	2760	µg/kg	50	< 50				< 50	
1,2,4-Trichlorobenzene		M	2760	µg/kg	1.0	< 1.0				< 1.0	
Hexachlorobutadiene		N	2760	µg/kg	1.0	< 1.0				< 1.0	
1,2,3-Trichlorobenzene		U	2760	µg/kg	2.0	< 2.0				< 2.0	
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0				< 1.0	
N-Nitrosodimethylamine		M	2790	mg/kg	0.50	< 0.50				< 0.50	
Phenol		M	2790	mg/kg	0.50	< 0.50				< 0.50	
2-Chlorophenol		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Bis-(2-Chloroethyl)Ether		M	2790	mg/kg	0.50	< 0.50				< 0.50	
1,3-Dichlorobenzene		M	2790	mg/kg	0.50	< 0.50				< 0.50	
1,4-Dichlorobenzene		N	2790	mg/kg	0.50	< 0.50				< 0.50	
1,2-Dichlorobenzene		M	2790	mg/kg	0.50	< 0.50				< 0.50	
2-Methylphenol		M	2790	mg/kg	0.50	< 0.50				< 0.50	
Bis(2-Chloroisopropyl)Ether		M	2790	mg/kg	0.50	< 0.50				< 0.50	
Hexachloroethane		N	2790	mg/kg	0.50	< 0.50				< 0.50	
N-Nitrosodi-n-propylamine		M	2790	mg/kg	0.50	< 0.50				< 0.50	
4-Methylphenol		M	2790	mg/kg	0.50	< 0.50				< 0.50	
Nitrobenzene		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Isophorone		M	2790	mg/kg	0.50	< 0.50				< 0.50	
2-Nitrophenol		N	2790	mg/kg	0.50	< 0.50				< 0.50	
2,4-Dimethylphenol		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Bis(2-Chloroethoxy)Methane		M	2790	mg/kg	0.50	< 0.50				< 0.50	
2,4-Dichlorophenol		N	2790	mg/kg	0.50	< 0.50				< 0.50	
1,2,4-Trichlorobenzene		M	2790	mg/kg	0.50	< 0.50				< 0.50	
Naphthalene		M	2790	mg/kg	0.50	1.9				19	
4-Chloroaniline		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Hexachlorobutadiene		M	2790	mg/kg	0.50	< 0.50				< 0.50	
4-Chloro-3-Methylphenol		N	2790	mg/kg	0.50	< 0.50				< 0.50	
2-Methylnaphthalene		M	2790	mg/kg	0.50	2.4				4.1	
4-Nitrophenol		N	2790	mg/kg	0.50	< 0.50				< 0.50	
2,4,6-Trichlorophenol		N	2790	mg/kg	0.50	< 0.50				< 0.50	
2,4,5-Trichlorophenol		N	2790	mg/kg	0.50	< 0.50				< 0.50	
2-Chloronaphthalene		M	2790	mg/kg	0.50	< 0.50				< 0.50	
2-Nitroaniline		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Acenaphthylene		M	2790	mg/kg	0.50	0.84				< 0.50	
Dimethylphthalate		M	2790	mg/kg	0.50	< 0.50				< 0.50	
2,6-Dinitrotoluene		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Acenaphthene		M	2790	mg/kg	0.50	6.8				6.8	
3-Nitroaniline		N	2790	mg/kg	0.50	< 0.50				< 0.50	

Results - Soil

Project: 17-403 Rybank Fields

Client: E3P				**Chemtest Job No.:**		24-22675	24-22675	24-22675	24-22675	24-22675	24-22675
Quotation No.:				**Chemtest Sample ID.:**		1836726	1836727	1836729	1836730	1836731	1836732
				Client Sample ID.:		CP201	CP201	CP202	CP203	CP203	CP203
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		5.00	11.00	16.00	1.00	5.00	13.20
				Date Sampled:		09-Jul-2024	09-Jul-2024	09-Jul-2024	11-Jul-2024	11-Jul-2024	11-Jul-2024
				Asbestos Lab:		NEW-ASB			NEW-ASB	NEW-ASB	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
Dibenzofuran		M	2790	mg/kg	0.50	8.7				4.2	
4-Chlorophenylphenylether		M	2790	mg/kg	0.50	< 0.50				< 0.50	
2,4-Dinitrotoluene		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Fluorene		M	2790	mg/kg	0.50	18				5.1	
Diethyl Phthalate		M	2790	mg/kg	0.50	< 0.50				< 0.50	
4-Nitroaniline		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Azobenzene		M	2790	mg/kg	0.50	< 0.50				< 0.50	
4-Bromophenylphenyl Ether		M	2790	mg/kg	0.50	< 0.50				< 0.50	
Hexachlorobenzene		M	2790	mg/kg	0.50	< 0.50				< 0.50	
Phenanthrene		M	2790	mg/kg	0.50	90				35	
Anthracene		M	2790	mg/kg	0.50	25				6.7	
Carbazole		M	2790	mg/kg	0.50	8.2				2.6	
Di-N-Butyl Phthalate		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Fluoranthene		M	2790	mg/kg	0.50	73				27	
Pyrene		M	2790	mg/kg	0.50	54				22	
Butylbenzyl Phthalate		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Benzo[a]anthracene		M	2790	mg/kg	0.50	26				7.3	
Chrysene		M	2790	mg/kg	0.50	22				7.0	
Bis(2-Ethylhexyl)Phthalate		N	2790	mg/kg	0.50	0.75				< 0.50	
Di-N-Octyl Phthalate		N	2790	mg/kg	0.50	< 0.50				< 0.50	
Benzo[b]fluoranthene		M	2790	mg/kg	0.50	23				7.2	
Benzo[k]fluoranthene		M	2790	mg/kg	0.50	7.5				2.6	
Benzo[a]pyrene		M	2790	mg/kg	0.50	17				6.2	
Indeno(1,2,3-c,d)Pyrene		N	2790	mg/kg	0.50	7.7				2.9	
Dibenz(a,h)Anthracene		N	2790	mg/kg	0.50	2.0				0.65	
Benzo[g,h,i]perylene		M	2790	mg/kg	0.50	7.8				3.3	
Naphthalene		M	2800	mg/kg	0.10		0.54	< 0.10	0.36		4.5
Acenaphthylene		N	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10		< 0.10
Acenaphthene		M	2800	mg/kg	0.10		< 0.10	< 0.10	0.30		< 0.10
Fluorene		M	2800	mg/kg	0.10		< 0.10	< 0.10	0.31		< 0.10
Phenanthrene		M	2800	mg/kg	0.10		0.99	< 0.10	2.3		7.2
Anthracene		M	2800	mg/kg	0.10		0.38	< 0.10	0.59		1.7
Fluoranthene		M	2800	mg/kg	0.10		0.77	< 0.10	3.1		4.5
Pyrene		M	2800	mg/kg	0.10		0.60	< 0.10	2.6		3.7
Benzo[a]anthracene		M	2800	mg/kg	0.10		< 0.10	< 0.10	0.21		1.4
Chrysene		M	2800	mg/kg	0.10		< 0.10	< 0.10	1.2		1.5
Benzo[b]fluoranthene		M	2800	mg/kg	0.10		< 0.10	< 0.10	0.57		1.7
Benzo[k]fluoranthene		M	2800	mg/kg	0.10		< 0.10	< 0.10	0.52		0.54
Benzo[a]pyrene		M	2800	mg/kg	0.10		< 0.10	< 0.10	1.3		1.4

Results - Soil

Project: 17-403 Rybank Fields

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				Date Sampled:		09-Jul-2024	09-Jul-2024	09-Jul-2024	11-Jul-2024	11-Jul-2024	11-Jul-2024
				Asbestos Lab:		NEW-ASB			NEW-ASB	NEW-ASB	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10		0.80
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10		< 0.10	< 0.10	0.23		< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10		< 0.10	< 0.10	0.53		0.71
Total Of 16 PAH's		N	2800	mg/kg	2.0		3.3	< 2.0	14		30
PCB 28		U	2815	mg/kg	0.010						
PCB 52		U	2815	mg/kg	0.010						
PCB 101		U	2815	mg/kg	0.010						
PCB 118		U	2815	mg/kg	0.010						
PCB 153		U	2815	mg/kg	0.010						
PCB 138		U	2815	mg/kg	0.010						
PCB 180		U	2815	mg/kg	0.010						
Total PCBs (7 Congeners)		N	2815	mg/kg	0.10						
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	6.2

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS. Reported PCB 101 results may contain contributions from PCB 90 due to inseparable chromatography.	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
Uncertainty of measurement for the determinands tested are available upon request .
None of the results in this report have been recovery corrected.
All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated laboratory .
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.
All water samples will be retained for 14 days from the date of receipt.
Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

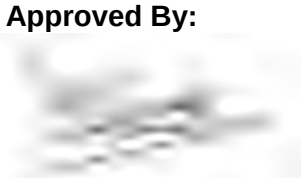
HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	24-23593-1
Initial Date of Issue:	02-Aug-2024
Re-Issue Details:	
Client	E3P
Client Address:	Taylor Road Trafford Park Urmston Manchester M41 7JQ
Contact(s):	jwaugh@e3p.co.uk; rhodnett@e3p.co.uk; gcalvert@e3p.co.uk; ndawson@e3p.co.uk
Project	Reybank Fields - Hand pits
Quotation No.:	Q23-31421
Date Received:	25-Jul-2024
Order No.:	8801
Date Instructed:	25-Jul-2024
No. of Samples:	2
Turnaround (Wkdays):	5
Results Due:	31-Jul-2024
Date Approved:	02-Aug-2024
Approved By:	



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: Reybank Fields - Hand pits

Client: E3P				**Chemtest Job No.:**		24-23593	24-23593
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1840274	1840275
Order No.: 8801				Client Sample Ref.:		HP201	HP202
				Client Sample ID.:		HP201	HP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.10	0.90
				Date Sampled:		18-Jul-2024	18-Jul-2024
				Time Sampled:		12:00	12:00
				Asbestos Lab:			NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type		U	2192		N/A		-
Asbestos Identification		U	2192		N/A		No Asbestos Detected
Moisture		N	2030	%	0.020	29	12
Soil Colour		N	2040		N/A		Brown
Other Material		N	2040		N/A		Stones and Roots
Soil Texture		N	2040		N/A		Loam
pH at 20C		M	2010		4.0		8.4
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010		< 0.010
Total Sulphur		U	2175	%	0.010		0.060
Cyanide (Total)		M	2300	mg/kg	0.50		0.70
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50		4.2
Sulphate (Total)		U	2430	%	0.010		0.026
Arsenic		M	2455	mg/kg	0.5		6.6
Cadmium		M	2455	mg/kg	0.10		< 0.10
Chromium		M	2455	mg/kg	0.5		6.8
Copper		M	2455	mg/kg	0.50		150
Mercury		M	2455	mg/kg	0.05		0.21
Nickel		M	2455	mg/kg	0.50		6.9
Lead		M	2455	mg/kg	0.50		57
Selenium		M	2455	mg/kg	0.25		< 0.25
Zinc		M	2455	mg/kg	0.50		54
Chromium (Hexavalent)		N	2490	mg/kg	0.50		< 0.50
Organic Matter		M	2625	%	0.40		5.0
Total Organic Carbon		M	2625	%	0.20		2.9
TPH >C6-C8	EH_1D_Total	N	2670	mg/kg	1.0		< 1.0
TPH >C8-C10	EH_1D_Total	N	2670	mg/kg	1.0		< 1.0
TPH >C10-C12	EH_1D_Total	N	2670	mg/kg	1.0		< 1.0
TPH >C12-C16	EH_1D_Total	N	2670	mg/kg	1.0		8.4
TPH >C16-C21	EH_1D_Total	N	2670	mg/kg	1.0		12
TPH >C21-C25	EH_1D_Total	N	2670	mg/kg	1.0		7.4
TPH >C25-C35	EH_1D_Total	N	2670	mg/kg	1.0		19
TPH >C35-C40	EH_1D_Total	N	2670	mg/kg	1.0		3.3
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10		51
N-Nitrosodimethylamine		M	2790	mg/kg	0.50		< 0.50
Phenol		M	2790	mg/kg	0.50		< 0.50

Results - Soil

Project: Reybank Fields - Hand pits

Client: E3P				**Chemtest Job No.:**		24-23593	24-23593
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1840274	1840275
Order No.: 8801				Client Sample Ref.:		HP201	HP202
				Client Sample ID.:		HP201	HP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.10	0.90
				Date Sampled:		18-Jul-2024	18-Jul-2024
				Time Sampled:		12:00	12:00
				Asbestos Lab:			NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
2-Chlorophenol		N	2790	mg/kg	0.50		< 0.50
Bis-(2-Chloroethyl)Ether		M	2790	mg/kg	0.50		< 0.50
1,3-Dichlorobenzene		M	2790	mg/kg	0.50		< 0.50
1,4-Dichlorobenzene		N	2790	mg/kg	0.50		< 0.50
1,2-Dichlorobenzene		M	2790	mg/kg	0.50		< 0.50
2-Methylphenol		M	2790	mg/kg	0.50		< 0.50
Bis(2-Chloroisopropyl)Ether		M	2790	mg/kg	0.50		< 0.50
Hexachloroethane		N	2790	mg/kg	0.50		< 0.50
N-Nitrosodi-n-propylamine		M	2790	mg/kg	0.50		< 0.50
4-Methylphenol		M	2790	mg/kg	0.50		< 0.50
Nitrobenzene		N	2790	mg/kg	0.50		< 0.50
Isophorone		M	2790	mg/kg	0.50		< 0.50
2-Nitrophenol		N	2790	mg/kg	0.50		< 0.50
2,4-Dimethylphenol		N	2790	mg/kg	0.50		< 0.50
Bis(2-Chloroethoxy)Methane		M	2790	mg/kg	0.50		< 0.50
2,4-Dichlorophenol		N	2790	mg/kg	0.50		< 0.50
1,2,4-Trichlorobenzene		M	2790	mg/kg	0.50		< 0.50
Naphthalene		M	2790	mg/kg	0.50		< 0.50
4-Chloroaniline		N	2790	mg/kg	0.50		< 0.50
Hexachlorobutadiene		M	2790	mg/kg	0.50		< 0.50
4-Chloro-3-Methylphenol		N	2790	mg/kg	0.50		< 0.50
2-Methylnaphthalene		M	2790	mg/kg	0.50		< 0.50
4-Nitrophenol		N	2790	mg/kg	0.50		< 0.50
2,4,6-Trichlorophenol		N	2790	mg/kg	0.50		< 0.50
2,4,5-Trichlorophenol		N	2790	mg/kg	0.50		< 0.50
2-Chloronaphthalene		M	2790	mg/kg	0.50		< 0.50
2-Nitroaniline		N	2790	mg/kg	0.50		< 0.50
Acenaphthylene		M	2790	mg/kg	0.50		< 0.50
Dimethylphthalate		M	2790	mg/kg	0.50		< 0.50
2,6-Dinitrotoluene		N	2790	mg/kg	0.50		< 0.50
Acenaphthene		M	2790	mg/kg	0.50		< 0.50
3-Nitroaniline		N	2790	mg/kg	0.50		< 0.50
Dibenzofuran		M	2790	mg/kg	0.50		< 0.50
4-Chlorophenylphenylether		M	2790	mg/kg	0.50		< 0.50
2,4-Dinitrotoluene		N	2790	mg/kg	0.50		< 0.50
Fluorene		M	2790	mg/kg	0.50		< 0.50
Diethyl Phthalate		M	2790	mg/kg	0.50		< 0.50

Results - Soil

Project: Reybank Fields - Hand pits

Client: E3P				**Chemtest Job No.:**		24-23593	24-23593
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1840274	1840275
Order No.: 8801				Client Sample Ref.:		HP201	HP202
				Client Sample ID.:		HP201	HP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.10	0.90
				Date Sampled:		18-Jul-2024	18-Jul-2024
				Time Sampled:		12:00	12:00
				Asbestos Lab:			NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
4-Nitroaniline		N	2790	mg/kg	0.50		< 0.50
Azobenzene		M	2790	mg/kg	0.50		< 0.50
4-Bromophenylphenyl Ether		M	2790	mg/kg	0.50		< 0.50
Hexachlorobenzene		M	2790	mg/kg	0.50		< 0.50
Phenanthrene		M	2790	mg/kg	0.50		0.74
Anthracene		M	2790	mg/kg	0.50		< 0.50
Carbazole		M	2790	mg/kg	0.50		< 0.50
Di-N-Butyl Phthalate		N	2790	mg/kg	0.50		< 0.50
Fluoranthene		M	2790	mg/kg	0.50		1.3
Pyrene		M	2790	mg/kg	0.50		1.4
Butylbenzyl Phthalate		N	2790	mg/kg	0.50		< 0.50
Benzo[a]anthracene		M	2790	mg/kg	0.50		0.78
Chrysene		M	2790	mg/kg	0.50		0.70
Bis(2-Ethylhexyl)Phthalate		N	2790	mg/kg	0.50		< 0.50
Di-N-Octyl Phthalate		N	2790	mg/kg	0.50		< 0.50
Benzo[b]fluoranthene		M	2790	mg/kg	0.50		0.98
Benzo[k]fluoranthene		M	2790	mg/kg	0.50		< 0.50
Benzo[a]pyrene		M	2790	mg/kg	0.50		0.83
Indeno(1,2,3-c,d)Pyrene		N	2790	mg/kg	0.50		< 0.50
Dibenz(a,h)Anthracene		N	2790	mg/kg	0.50		< 0.50
Benzo[g,h,i]perylene		M	2790	mg/kg	0.50		< 0.50
Naphthalene		M	2800	mg/kg	0.10		0.41
Acenaphthylene		N	2800	mg/kg	0.10		< 0.10
Acenaphthene		M	2800	mg/kg	0.10		< 0.10
Fluorene		M	2800	mg/kg	0.10		< 0.10
Phenanthrene		M	2800	mg/kg	0.10		2.4
Anthracene		M	2800	mg/kg	0.10		0.55
Fluoranthene		M	2800	mg/kg	0.10		3.4
Pyrene		M	2800	mg/kg	0.10		3.1
Benzo[a]anthracene		M	2800	mg/kg	0.10		1.4
Chrysene		M	2800	mg/kg	0.10		1.8
Benzo[b]fluoranthene		M	2800	mg/kg	0.10		1.9
Benzo[k]fluoranthene		M	2800	mg/kg	0.10		0.71
Benzo[a]pyrene		M	2800	mg/kg	0.10		1.6
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10		1.0
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10		< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10		1.0

Results - Soil

Project: Reybank Fields - Hand pits

Client: E3P				**Chemtest Job No.:**		24-23593	24-23593
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1840274	1840275
Order No.: 8801				Client Sample Ref.:		HP201	HP202
				Client Sample ID.:		HP201	HP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.10	0.90
				Date Sampled:		18-Jul-2024	18-Jul-2024
				Time Sampled:		12:00	12:00
				Asbestos Lab:			NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
Total Of 16 PAH's		N	2800	mg/kg	2.0		19
Total Phenols		M	2920	mg/kg	0.10		< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation	
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	
2010	pH Value of Soils	pH at 20°C	pH Meter	
2015	Acid Neutralisation Capacity	Acid Reserve	Titration	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS. Reported PCB 101 results may contain contributions from PCB 90 due to inseparable chromatography.	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
Uncertainty of measurement for the determinands tested are available upon request .
None of the results in this report have been recovery corrected.
All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated laboratory .
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.
All water samples will be retained for 14 days from the date of receipt.
Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

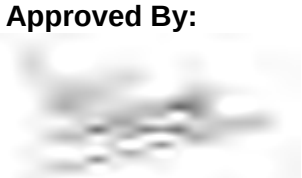
If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Amended Report

Report No.:	24-23593-3		
Initial Date of Issue:	02-Aug-2024	**Date of Re-Issue:**	02-Aug-2024
Re-Issue Details:	This report has been revised and directly supersedes 24-23593-2 in its entirety		
Client	E3P		
Client Address:	Taylor Road Trafford Park Urmston Manchester M41 7JQ		
Contact(s):	jwaugh@e3p.co.uk; rhodnett@e3p.co.uk; gcalvert@e3p.co.uk; ndawson@e3p.co.uk		
Project	Reybank Fields - Hand pits		
Quotation No.:	Q23-31421	**Date Received:**	25-Jul-2024
Order No.:	8801	**Date Instructed:**	25-Jul-2024
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	31-Jul-2024
Date Approved:	02-Aug-2024		

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: Reybank Fields - Hand pits

Client: E3P				**Chemtest Job No.:**		24-23593	24-23593
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1840274	1840275
Order No.: 8801				Client Sample Ref.:		HP201	HP202
				Client Sample ID.:		HP201	HP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.10	0.90
				Date Sampled:		18-Jul-2024	18-Jul-2024
				Time Sampled:		12:00	12:00
				Asbestos Lab:			NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type		U	2192		N/A		-
Asbestos Identification		U	2192		N/A		No Asbestos Detected
Moisture		N	2030	%	0.020	29	12
Soil Colour		N	2040		N/A		Brown
Other Material		N	2040		N/A		Stones and Roots
Soil Texture		N	2040		N/A		Loam
pH at 20C		M	2010		4.0		8.4
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010		< 0.010
Total Sulphur		U	2175	%	0.010		0.060
Cyanide (Total)		M	2300	mg/kg	0.50		0.70
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50		4.2
Sulphate (Total)		U	2430	%	0.010		0.026
Arsenic		M	2455	mg/kg	0.5		6.6
Cadmium		M	2455	mg/kg	0.10		< 0.10
Chromium		M	2455	mg/kg	0.5		6.8
Copper		M	2455	mg/kg	0.50		150
Mercury		M	2455	mg/kg	0.05		0.21
Nickel		M	2455	mg/kg	0.50		6.9
Lead		M	2455	mg/kg	0.50		57
Selenium		M	2455	mg/kg	0.25		< 0.25
Zinc		M	2455	mg/kg	0.50		54
Chromium (Hexavalent)		N	2490	mg/kg	0.50		< 0.50
Organic Matter		M	2625	%	0.40		5.0
Total Organic Carbon		M	2625	%	0.20		2.9
TPH >C6-C8	EH_1D_Total	N	2670	mg/kg	1.0		< 1.0
TPH >C8-C10	EH_1D_Total	N	2670	mg/kg	1.0		< 1.0
TPH >C10-C12	EH_1D_Total	N	2670	mg/kg	1.0		< 1.0
TPH >C12-C16	EH_1D_Total	N	2670	mg/kg	1.0		8.4
TPH >C16-C21	EH_1D_Total	N	2670	mg/kg	1.0		12
TPH >C21-C25	EH_1D_Total	N	2670	mg/kg	1.0		7.4
TPH >C25-C35	EH_1D_Total	N	2670	mg/kg	1.0		19
TPH >C35-C40	EH_1D_Total	N	2670	mg/kg	1.0		3.3
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10		51
N-Nitrosodimethylamine		M	2790	mg/kg	0.50		< 0.50
Phenol		M	2790	mg/kg	0.50		< 0.50

Results - Soil

Project: Reybank Fields - Hand pits

Client: E3P				**Chemtest Job No.:**		24-23593	24-23593
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1840274	1840275
Order No.: 8801				Client Sample Ref.:		HP201	HP202
				Client Sample ID.:		HP201	HP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.10	0.90
				Date Sampled:		18-Jul-2024	18-Jul-2024
				Time Sampled:		12:00	12:00
				Asbestos Lab:			NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
2-Chlorophenol		N	2790	mg/kg	0.50		< 0.50
Bis-(2-Chloroethyl)Ether		M	2790	mg/kg	0.50		< 0.50
1,3-Dichlorobenzene		M	2790	mg/kg	0.50		< 0.50
1,4-Dichlorobenzene		N	2790	mg/kg	0.50		< 0.50
1,2-Dichlorobenzene		M	2790	mg/kg	0.50		< 0.50
2-Methylphenol		M	2790	mg/kg	0.50		< 0.50
Bis(2-Chloroisopropyl)Ether		M	2790	mg/kg	0.50		< 0.50
Hexachloroethane		N	2790	mg/kg	0.50		< 0.50
N-Nitrosodi-n-propylamine		M	2790	mg/kg	0.50		< 0.50
4-Methylphenol		M	2790	mg/kg	0.50		< 0.50
Nitrobenzene		N	2790	mg/kg	0.50		< 0.50
Isophorone		M	2790	mg/kg	0.50		< 0.50
2-Nitrophenol		N	2790	mg/kg	0.50		< 0.50
2,4-Dimethylphenol		N	2790	mg/kg	0.50		< 0.50
Bis(2-Chloroethoxy)Methane		M	2790	mg/kg	0.50		< 0.50
2,4-Dichlorophenol		N	2790	mg/kg	0.50		< 0.50
1,2,4-Trichlorobenzene		M	2790	mg/kg	0.50		< 0.50
Naphthalene		M	2790	mg/kg	0.50		< 0.50
4-Chloroaniline		N	2790	mg/kg	0.50		< 0.50
Hexachlorobutadiene		M	2790	mg/kg	0.50		< 0.50
4-Chloro-3-Methylphenol		N	2790	mg/kg	0.50		< 0.50
2-Methylnaphthalene		M	2790	mg/kg	0.50		< 0.50
4-Nitrophenol		N	2790	mg/kg	0.50		< 0.50
2,4,6-Trichlorophenol		N	2790	mg/kg	0.50		< 0.50
2,4,5-Trichlorophenol		N	2790	mg/kg	0.50		< 0.50
2-Chloronaphthalene		M	2790	mg/kg	0.50		< 0.50
2-Nitroaniline		N	2790	mg/kg	0.50		< 0.50
Acenaphthylene		M	2790	mg/kg	0.50		< 0.50
Dimethylphthalate		M	2790	mg/kg	0.50		< 0.50
2,6-Dinitrotoluene		N	2790	mg/kg	0.50		< 0.50
Acenaphthene		M	2790	mg/kg	0.50		< 0.50
3-Nitroaniline		N	2790	mg/kg	0.50		< 0.50
Dibenzofuran		M	2790	mg/kg	0.50		< 0.50
4-Chlorophenylphenylether		M	2790	mg/kg	0.50		< 0.50
2,4-Dinitrotoluene		N	2790	mg/kg	0.50		< 0.50
Fluorene		M	2790	mg/kg	0.50		< 0.50
Diethyl Phthalate		M	2790	mg/kg	0.50		< 0.50

Results - Soil

Project: Reybank Fields - Hand pits

Client: E3P				**Chemtest Job No.:**		24-23593	24-23593
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1840274	1840275
Order No.: 8801				Client Sample Ref.:		HP201	HP202
				Client Sample ID.:		HP201	HP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.10	0.90
				Date Sampled:		18-Jul-2024	18-Jul-2024
				Time Sampled:		12:00	12:00
				Asbestos Lab:			NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
4-Nitroaniline		N	2790	mg/kg	0.50		< 0.50
Azobenzene		M	2790	mg/kg	0.50		< 0.50
4-Bromophenylphenyl Ether		M	2790	mg/kg	0.50		< 0.50
Hexachlorobenzene		M	2790	mg/kg	0.50		< 0.50
Phenanthrene		M	2790	mg/kg	0.50		0.74
Anthracene		M	2790	mg/kg	0.50		< 0.50
Carbazole		M	2790	mg/kg	0.50		< 0.50
Di-N-Butyl Phthalate		N	2790	mg/kg	0.50		< 0.50
Fluoranthene		M	2790	mg/kg	0.50		1.3
Pyrene		M	2790	mg/kg	0.50		1.4
Butylbenzyl Phthalate		N	2790	mg/kg	0.50		< 0.50
Benzo[a]anthracene		M	2790	mg/kg	0.50		0.78
Chrysene		M	2790	mg/kg	0.50		0.70
Bis(2-Ethylhexyl)Phthalate		N	2790	mg/kg	0.50		< 0.50
Di-N-Octyl Phthalate		N	2790	mg/kg	0.50		< 0.50
Benzo[b]fluoranthene		M	2790	mg/kg	0.50		0.98
Benzo[k]fluoranthene		M	2790	mg/kg	0.50		< 0.50
Benzo[a]pyrene		M	2790	mg/kg	0.50		0.83
Indeno(1,2,3-c,d)Pyrene		N	2790	mg/kg	0.50		< 0.50
Dibenz(a,h)Anthracene		N	2790	mg/kg	0.50		< 0.50
Benzo[g,h,i]perylene		M	2790	mg/kg	0.50		< 0.50
Naphthalene		M	2800	mg/kg	0.10		0.41
Acenaphthylene		N	2800	mg/kg	0.10		< 0.10
Acenaphthene		M	2800	mg/kg	0.10		< 0.10
Fluorene		M	2800	mg/kg	0.10		< 0.10
Phenanthrene		M	2800	mg/kg	0.10		2.4
Anthracene		M	2800	mg/kg	0.10		0.55
Fluoranthene		M	2800	mg/kg	0.10		3.4
Pyrene		M	2800	mg/kg	0.10		3.1
Benzo[a]anthracene		M	2800	mg/kg	0.10		1.4
Chrysene		M	2800	mg/kg	0.10		1.8
Benzo[b]fluoranthene		M	2800	mg/kg	0.10		1.9
Benzo[k]fluoranthene		M	2800	mg/kg	0.10		0.71
Benzo[a]pyrene		M	2800	mg/kg	0.10		1.6
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10		1.0
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10		< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10		1.0

Results - Soil

Project: Reybank Fields - Hand pits

Client: E3P				**Chemtest Job No.:**		24-23593	24-23593
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1840274	1840275
Order No.: 8801				Client Sample Ref.:		HP201	HP202
				Client Sample ID.:		HP201	HP202
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.10	0.90
				Date Sampled:		18-Jul-2024	18-Jul-2024
				Time Sampled:		12:00	12:00
				Asbestos Lab:			NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
Total Of 16 PAH's		N	2800	mg/kg	2.0		19
Total Phenols		M	2920	mg/kg	0.10		< 0.10

Results - 2 Stage WAC

Project: Reybank Fields - Hand pits

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-23593								
Chemtest Sample ID:	1840274								
Sample Ref:	HP201								
Sample ID:	HP201								
Sample Location:									
Top Depth(m):	0.10								
Bottom Depth(m):									
Sampling Date:	18-Jul-2024								
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			10	3	5	6
Loss On Ignition	2610	M	%			16	--	--	10
Total BTEX	2760	M	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg			< 2.0	100	--	--
pH at 20C	2010	M				8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.011	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0014	0.0014	0.0027	0.014	0.5	2	25
Barium	1455	U	0.034	0.012	0.065	0.13	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.0008	0.0005	0.0015	0.0054	0.5	10	70
Copper	1455	U	0.0039	0.0022	0.0074	0.0031	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0028	0.0008	0.0052	0.0099	0.5	10	30
Nickel	1455	U	0.0013	< 0.0005	0.0025	0.0011	0.4	10	40
Lead	1455	U	0.0008	0.0014	0.0015	0.013	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	0.003	0.003	0.006	0.034	4	50	200
Chloride	1220	U	2.3	< 1.0	< 10	< 10	800	15000	25000
Fluoride	1220	U	0.13	0.12	< 1.0	1.2	10	150	500
Sulphate	1220	U	< 1.0	< 1.0	< 10	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	140	67	260	710	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	12	5.4	< 50	58	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	29

Leachate Test Information	
Leachant volume 1st extract/l	0.279
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.141

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation	
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	
2010	pH Value of Soils	pH at 20°C	pH Meter	
2015	Acid Neutralisation Capacity	Acid Reserve	Titration	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS. Reported PCB 101 results may contain contributions from PCB 90 due to inseparable chromatography.	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
Uncertainty of measurement for the determinands tested are available upon request .
None of the results in this report have been recovery corrected.
All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated laboratory .
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.
All water samples will be retained for 14 days from the date of receipt.
Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Results - 2 Stage WAC

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:			24-22676				**Inert Waste Landfill**	**Stable Non-reactive Hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Chemtest Sample ID:			1836733						
Sample Ref:									
Sample ID:			WS207						
Sample Location:									
Top Depth(m):			0.40						
Bottom Depth(m):									
Sampling Date:			12-Jul-2024						
Determinand	**SOP**	**Accred.**	**Units**						
Total Organic Carbon	2625	M	%			3.7	3	5	6
Loss On Ignition	2610	M	%			7.0	--	--	10
Total BTEX	2760	M	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg			270	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg			200	100	--	--
pH at 20C	2010	M				8.1	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0090	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative 10:1 mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0028	0.0039	0.0055	0.038	0.5	2	25
Barium	1455	U	0.15	0.14	0.30	1.4	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.0044	0.0040	0.0087	0.040	0.5	10	70
Copper	1455	U	0.020	0.014	0.040	0.024	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0092	0.0059	0.018	0.063	0.5	10	30
Nickel	1455	U	0.0008	0.0009	0.0015	0.0086	0.4	10	40
Lead	1455	U	0.0038	0.0041	0.0075	0.041	0.5	10	50
Antimony	1455	U	0.025	0.027	0.050	0.26	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	0.026	0.010	0.051	0.12	4	50	200
Chloride	1220	U	1.6	< 1.0	< 10	< 10	800	15000	25000
Fluoride	1220	U	0.45	0.41	< 1.0	4.1	10	150	500
Sulphate	1220	U	12	6.9	24	75	1000	20000	50000
Total Dissolved Solids	1020	N	170	110	340	1100	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	6.7	4.0	< 50	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	14

Leachate Test Information	
Leachant volume 1st extract/l	0.321
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.208

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:			24-22676				**Inert Waste Landfill**	**Stable Non-reactive Hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Chemtest Sample ID:			1836734						
Sample Ref:									
Sample ID:			CP204						
Sample Location:									
Top Depth(m):			2.50						
Bottom Depth(m):									
Sampling Date:			12-Jul-2024						
Determinand	**SOP**	**Accred.**	**Units**						
Total Organic Carbon	2625	M	%			3.8	3	5	6
Loss On Ignition	2610	M	%			5.8	--	--	10
Total BTEX	2760	M	mg/kg			0.021	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg			120	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg			15	100	--	--
pH at 20C	2010	M				11.1	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.0070	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative 10:1 mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.017	0.016	0.033	0.16	0.5	2	25
Barium	1455	U	0.029	0.014	0.057	0.16	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.0059	0.0031	0.012	0.035	0.5	10	70
Copper	1455	U	0.029	0.0080	0.056	0.049	2	50	100
Mercury	1455	U	0.00037	0.00007	0.00072	0.0012	0.01	0.2	2
Molybdenum	1455	U	0.12	0.019	0.24	0.36	0.5	10	30
Nickel	1455	U	0.0061	0.0013	0.012	0.021	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	0.038	0.011	0.074	0.16	0.06	0.7	5
Selenium	1455	U	0.0028	0.0010	0.0054	0.013	0.1	0.5	7
Zinc	1455	U	< 0.003	0.003	< 0.003	0.027	4	50	200
Chloride	1220	U	50	5.5	98	130	800	15000	25000
Fluoride	1220	U	1.3	0.54	2.6	6.7	10	150	500
Sulphate	1220	U	120	23	240	400	1000	20000	50000
Total Dissolved Solids	1020	N	290	130	580	1600	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	17	4.7	< 50	67	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	16

Leachate Test Information	
Leachant volume 1st extract/l	0.316
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.296

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:			24-23593						
Chemtest Sample ID:			1840274						
Sample Ref:			HP201						
Sample ID:			HP201						
Sample Location:									
Top Depth(m):			0.10						
Bottom Depth(m):									
Sampling Date:			18-Jul-2024						
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable Non-reactive Hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			10	3	5	6
Loss On Ignition	2610	M	%			16	--	--	10
Total BTEX	2760	M	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg			< 2.0	100	--	--
pH at 20C	2010	M				8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.011	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative 10:1 mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0014	0.0014	0.0027	0.014	0.5	2	25
Barium	1455	U	0.034	0.012	0.065	0.13	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.0008	0.0005	0.0015	0.0054	0.5	10	70
Copper	1455	U	0.0039	0.0022	0.0074	0.0031	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0028	0.0008	0.0052	0.0099	0.5	10	30
Nickel	1455	U	0.0013	< 0.0005	0.0025	0.0011	0.4	10	40
Lead	1455	U	0.0008	0.0014	0.0015	0.013	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	0.003	0.003	0.006	0.034	4	50	200
Chloride	1220	U	2.3	< 1.0	< 10	< 10	800	15000	25000
Fluoride	1220	U	0.13	0.12	< 1.0	1.2	10	150	500
Sulphate	1220	U	< 1.0	< 1.0	< 10	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	140	67	260	710	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	12	5.4	< 50	58	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	29

Leachate Test Information	
Leachant volume 1st extract/l	0.279
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.141

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

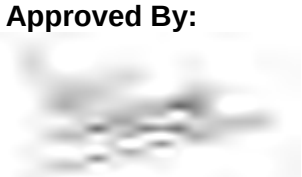
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	24-24409-1
Initial Date of Issue:	08-Aug-2024
Re-Issue Details:	
Client	E3P
Client Address:	Taylor Road Trafford Park Urmston Manchester M41 7JQ
Contact(s):	ndawson@e3p.co.uk; gcalvert@e3p.co.uk; rhodnett@e3p.co.uk
Project	Ryebank Fields

Quotation No.:	Q23-31421	**Date Received:**	31-Jul-2024
Order No.:	009006	**Date Instructed:**	31-Jul-2024
No. of Samples:	3		
Turnaround (Wkdays):	5	**Results Due:**	06-Aug-2024
Date Approved:	08-Aug-2024		

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Water

Project: Ryebank Fields

Client: E3P				**Chemtest Job No.:**		24-24409	24-24409
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1843943	1843944
				Client Sample ID.:		WS202	WS205
				Sample Type:		WATER	WATER
				Sample Sub Type:			
				Date Sampled:		29-Jul-2024	29-Jul-2024
				Time Sampled:		12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
pH at 20C		U	1010		4.0	8.7	8.9
Cyanide (Total) Low-Level		N	1300	mg/l	0.0050	< 0.0050	< 0.0050
Calcium (Dissolved)		U	1455	mg/l	2.00	21	17
Arsenic (Dissolved)		U	1455	µg/l	0.20	18	28
Cadmium (Dissolved)		U	1455	µg/l	0.11	< 0.11	< 0.11
Chromium (Dissolved)		U	1455	µg/l	0.50	3.1	2.7
Copper (Dissolved)		U	1455	µg/l	0.50	2.7	2.3
Manganese (Dissolved)		U	1455	µg/l	0.50	6.4	3.2
Nickel (Dissolved)		U	1455	µg/l	0.50	5.2	6.1
Lead (Dissolved)		U	1455	µg/l	0.50	4.0	1.3
Selenium (Dissolved)		U	1455	µg/l	0.50	1.9	4.3
Zinc (Dissolved)		U	1455	µg/l	2.5	7.6	7.2
Mercury Low Level		U	1460	µg/l	0.010	< 0.010	< 0.010
Chromium (Hexavalent)		U	1490	µg/l	20	< 20	< 20
Dissolved Organic Carbon		U	1610	mg/l	2.0	20	14
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1675	µg/l	0.10	150	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1675	µg/l	0.10	130	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1675	µg/l	0.10	69	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	340	< 5.0
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	350	< 10
Dichlorodifluoromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
Chloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
Vinyl Chloride		N	1760	µg/l	1.0	< 1.0	< 1.0
Bromomethane		U	1760	µg/l	5	< 5	< 5
Chloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0

Results - Water

Project: Ryebank Fields

Client: E3P				**Chemtest Job No.:**		24-24409	24-24409
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1843943	1843944
				Client Sample ID.:		WS202	WS205
				Sample Type:		WATER	WATER
				Sample Sub Type:			
				Date Sampled:		29-Jul-2024	29-Jul-2024
				Time Sampled:		12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
Trichlorofluoromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
1,1-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,1-Dichloroethane		U	1760	µg/l	1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0
Bromochloromethane		U	1760	µg/l	5	< 5	< 5
Trichloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		U	1760	µg/l	1.0	< 1.0	< 1.0
Tetrachloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	1760	µg/l	1.0	< 1.0	< 1.0
Benzene		U	1760	µg/l	1.0	17	< 1.0
1,2-Dichloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0
Trichloroethene		N	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dichloropropane		U	1760	µg/l	1.0	< 1.0	< 1.0
Dibromomethane		U	1760	µg/l	10	< 10	< 10
Bromodichloromethane		U	1760	µg/l	5	< 5	< 5
cis-1,3-Dichloropropene		N	1760	µg/l	10	< 10	< 10
Toluene		U	1760	µg/l	1.0	1.7	< 1.0
Trans-1,3-Dichloropropene		N	1760	µg/l	10	< 10	< 10
1,1,2-Trichloroethane		U	1760	µg/l	10	< 10	< 10
Tetrachloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	1760	µg/l	2.0	< 2.0	< 2.0
Dibromochloromethane		U	1760	µg/l	10	< 10	< 10
1,2-Dibromoethane		U	1760	µg/l	5	< 5	< 5
Chlorobenzene		N	1760	µg/l	1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0
Ethylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
m & p-Xylene		U	1760	µg/l	1.0	< 1.0	< 1.0
o-Xylene		U	1760	µg/l	1.0	3.7	< 1.0
Styrene		U	1760	µg/l	1.0	< 1.0	< 1.0
Tribromomethane		U	1760	µg/l	1.0	< 1.0	< 1.0
Isopropylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
Bromobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	1760	µg/l	50	< 50	< 50
N-Propylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
2-Chlorotoluene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		U	1760	µg/l	1.0	3.2	< 1.0
4-Chlorotoluene		U	1760	µg/l	1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0

Results - Water

Project: Ryebank Fields

Client: E3P				**Chemtest Job No.:**		24-24409	24-24409
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1843943	1843944
				Client Sample ID.:		WS202	WS205
				Sample Type:		WATER	WATER
				Sample Sub Type:			
				Date Sampled:		29-Jul-2024	29-Jul-2024
				Time Sampled:		12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
1,2,4-Trimethylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,3-Dichlorobenzene		N	1760	µg/l	1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	1760	µg/l	1.0	2.3	< 1.0
1,4-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
N-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		U	1760	µg/l	50	< 50	< 50
1,2,4-Trichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
Hexachlorobutadiene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	1760	µg/l	2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		N	1760	µg/l	1.0	< 1.0	< 1.0
N-Nitrosodimethylamine		N	1790	µg/l	0.50	< 0.50	< 0.50
Phenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Chlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Bis-(2-Chloroethyl)Ether		N	1790	µg/l	0.50	< 0.50	< 0.50
1,3-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
1,4-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
1,2-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methylphenol (o-Cresol)		N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether		N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachloroethane		N	1790	µg/l	0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Methylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Nitrobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
Isophorone		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Nitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dimethylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Chloroethoxy)Methane		N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
Naphthalene		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chloroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachlorobutadiene		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methylnaphthalene		N	1790	µg/l	0.50	1.6	< 0.50
2,4,6-Trichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Chloronaphthalene		N	1790	µg/l	0.50	< 0.50	< 0.50

Results - Water

Project: Ryebank Fields

Client: E3P				**Chemtest Job No.:**		24-24409	24-24409
Quotation No.: Q23-31421				**Chemtest Sample ID.:**		1843943	1843944
				Client Sample ID.:		WS202	WS205
				Sample Type:		WATER	WATER
				Sample Sub Type:			
				Date Sampled:		29-Jul-2024	29-Jul-2024
				Time Sampled:		12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
2-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50
Acenaphthylene		N	1790	µg/l	0.50	6.3	< 0.50
Dimethylphthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
2,6-Dinitrotoluene		N	1790	µg/l	0.50	< 0.50	< 0.50
Acenaphthene		N	1790	µg/l	0.50	11	< 0.50
3-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50
Dibenzofuran		N	1790	µg/l	0.50	4.7	< 0.50
4-Chlorophenylphenylether		N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dinitrotoluene		N	1790	µg/l	0.50	< 0.50	< 0.50
Fluorene		N	1790	µg/l	0.50	4.3	< 0.50
Diethyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Azobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether		N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
Phenanthrene		N	1790	µg/l	0.50	< 0.50	< 0.50
Anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50
Carbazole		N	1790	µg/l	0.50	7.5	< 0.50
Di-N-Butyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
Fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50
Pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50
Butylbenzyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[a]anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50
Chrysene		N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[b]fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[k]fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[a]pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[g,h,i]perylene		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Nitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Total Phenols		U	1920	mg/l	0.030	0.083	< 0.030

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.	PL GW
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	PL GW
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation	PL SW GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.	PL GW
1790	Semi-Volatile Organic Compounds (SVOCs) in Waters by GC-MS	Semi-volatile organic compounds	Solvent extraction / GCMS detection	
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
Uncertainty of measurement for the determinands tested are available upon request .
None of the results in this report have been recovery corrected.
All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated laboratory .
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.
All water samples will be retained for 14 days from the date of receipt.
Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Amended Report

Report No.:	24-28971-2		
Initial Date of Issue:	25-Sep-2024	**Date of Re-Issue:**	25-Sep-2024
Re-Issue Details:	This report has been revised and directly supersedes 24-28971-1 in its entirety		
Client	E3P		
Client Address:	Taylor Road Trafford Park Urmston Manchester M41 7JQ		
Contact(s):	ndawson@e3p.co.uk		
Project	Ryebank Fields Waters		
Quotation No.:		**Date Received:**	09-Sep-2024
Order No.:	009567	**Date Instructed:**	09-Sep-2024
No. of Samples:	6		
Turnaround (Wkdays):	13	**Results Due:**	25-Sep-2024
Date Approved:	13-Sep-2024		
Approved By:			
Details:	David Smith, Technical Director		

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Water

Project: Ryebank Fields Waters

Client: E3P			**Chemtest Job No.:**			24-28971	24-28971	24-28971	24-28971	24-28971	24-28971
Quotation No.:			**Chemtest Sample ID.:**			1863710	1863711	1863712	1863713	1863714	1863715
			Client Sample ID.:			CP201	CP203	CP204	WS201	WS202	WS205
			Sample Type:			WATER	WATER	WATER	WATER	WATER	WATER
			Sample Sub Type:								
			Date Sampled:			02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024
			Time Sampled:			12:00	12:00	12:00	12:00	12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
pH at 20C		U	1010		4.0	8.2	8.3	8.0	8.3	8.6	9.1
Cyanide (Total)		U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.12	0.060
Calcium (Dissolved)		U	1455	mg/l	2.00	84	93	130	52	23	16
Arsenic (Dissolved)		U	1455	µg/l	0.20	2.3	8.5	2.7	6.3	6.5	27
Cadmium (Dissolved)		U	1455	µg/l	0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)		U	1455	µg/l	0.50	3.0	3.5	4.4	1.7	1.5	< 0.50
Copper (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Mercury (Dissolved)		U	1455	µg/l	0.05	0.09	< 0.05	< 0.05	0.06	0.14	0.06
Manganese (Dissolved)		U	1455	µg/l	0.50	100	300	880	47	20	1.6
Nickel (Dissolved)		U	1455	µg/l	0.50	1.5	1.3	1.6	2.1	0.92	3.3
Lead (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50	2.4	1.1	< 0.50
Selenium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Zinc (Dissolved)		U	1455	µg/l	2.5	3.3	3.8	4.4	3.3	2.8	3.2
Dissolved Organic Carbon		U	1610	mg/l	2.0	43	35	52	32	18	14
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	8.3	< 0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	12	< 0.10	350	< 0.10	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1675	µg/l	0.10	11	15	33	430	< 0.10	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1675	µg/l	0.10	12	6.2	16	170	< 0.10	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1675	µg/l	0.10	4.4	4.1	5.6	34	< 0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	27	37	55	990	< 5.0	< 5.0
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	27	37	55	990	< 10	< 10
Dichlorodifluoromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane		U	1760	µg/l	5	< 5	< 5	< 5	< 5	< 5	< 5
Chloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Water

Project: Ryebank Fields Waters

Client: E3P				**Chemtest Job No.:**		24-28971	24-28971	24-28971	24-28971	24-28971	24-28971
Quotation No.:				**Chemtest Sample ID.:**		1863710	1863711	1863712	1863713	1863714	1863715
				Client Sample ID.:		CP201	CP203	CP204	WS201	WS202	WS205
				Sample Type:		WATER	WATER	WATER	WATER	WATER	WATER
				Sample Sub Type:							
				Date Sampled:		02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024
				Time Sampled:		12:00	12:00	12:00	12:00	12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
1,1-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	1760	µg/l	5	< 5	< 5	< 5	< 5	< 5	< 5
Trichloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene		U	1760	µg/l	1.0	87	70	< 1.0	< 1.0	< 1.0	1.9
1,2-Dichloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		U	1760	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10
Bromodichloromethane		U	1760	µg/l	5	< 5	< 5	< 5	< 5	< 5	< 5
cis-1,3-Dichloropropene		N	1760	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10
Toluene		U	1760	µg/l	1.0	< 1.0	42	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene		N	1760	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10
1,1,2-Trichloroethane		U	1760	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10
Tetrachloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	1760	µg/l	10	< 10	< 10	< 10	< 10	< 10	< 10
1,2-Dibromoethane		U	1760	µg/l	5	< 5	< 5	< 5	< 5	< 5	< 5
Chlorobenzene		N	1760	µg/l	1.0	< 1.0	4.9	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		U	1760	µg/l	1.0	< 1.0	33	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		U	1760	µg/l	1.0	2.6	56	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene		U	1760	µg/l	1.0	3.4	78	< 1.0	< 1.0	< 1.0	< 1.0
Styrene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		U	1760	µg/l	1.0	1.3	8.3	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	1760	µg/l	50	< 50	< 50	< 50	< 50	< 50	< 50
N-Propylbenzene		U	1760	µg/l	1.0	< 1.0	5.8	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		U	1760	µg/l	1.0	< 1.0	19	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		U	1760	µg/l	1.0	40	19	< 1.0	< 1.0	< 1.0	< 1.0

Results - Water

Project: Ryebank Fields Waters

Client: E3P				**Chemtest Job No.:**		24-28971	24-28971	24-28971	24-28971	24-28971	24-28971
Quotation No.:				**Chemtest Sample ID.:**		1863710	1863711	1863712	1863713	1863714	1863715
				Client Sample ID.:		CP201	CP203	CP204	WS201	WS202	WS205
				Sample Type:		WATER	WATER	WATER	WATER	WATER	WATER
				Sample Sub Type:							
				Date Sampled:		02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024
				Time Sampled:		12:00	12:00	12:00	12:00	12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
Sec-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	1760	µg/l	1.0	< 1.0	1.7	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		U	1760	µg/l	50	< 50	< 50	< 50	< 50	< 50	< 50
1,2,4-Trichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Nitrosodimethylamine		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Phenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Chlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bis-(2-Chloroethyl)Ether		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,3-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,4-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,2-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Methylphenol (o-Cresol)		N	1790	µg/l	0.50	0.56	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Hexachloroethane		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Methylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Nitrobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Isophorone		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Nitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,4-Dimethylphenol		N	1790	µg/l	0.50	2.5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bis(2-Chloroethoxy)Methane		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,4-Dichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Naphthalene		N	1790	µg/l	0.50	95	5.0	270	7.4	9.7	1.3
4-Chloroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Hexachlorobutadiene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Methylnaphthalene		N	1790	µg/l	0.50	4.2	0.56	11	3.6	1.2	< 0.50
2,4,6-Trichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Chloronaphthalene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50

Results - Water

Project: Ryebank Fields Waters

Client: E3P				**Chemtest Job No.:**		24-28971	24-28971	24-28971	24-28971	24-28971	24-28971
Quotation No.:				**Chemtest Sample ID.:**		1863710	1863711	1863712	1863713	1863714	1863715
				Client Sample ID.:		CP201	CP203	CP204	WS201	WS202	WS205
				Sample Type:		WATER	WATER	WATER	WATER	WATER	WATER
				Sample Sub Type:							
				Date Sampled:		02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024	02-Sep-2024
				Time Sampled:		12:00	12:00	12:00	12:00	12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**						
Acenaphthylene		N	1790	µg/l	0.50	0.82	< 0.50	12	< 0.50	< 0.50	< 0.50
Dimethylphthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,6-Dinitrotoluene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Acenaphthene		N	1790	µg/l	0.50	3.4	0.73	17	11	4.5	< 0.50
3-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dibenzofuran		N	1790	µg/l	0.50	1.7	< 0.50	7.1	4.1	1.2	< 0.50
4-Chlorophenylphenylether		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,4-Dinitrotoluene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Fluorene		N	1790	µg/l	0.50	1.6	< 0.50	6.5	4.0	1.8	< 0.50
Diethyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Azobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Hexachlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Phenanthrene		N	1790	µg/l	0.50	3.4	0.84	7.3	5.3	3.4	< 0.50
Anthracene		N	1790	µg/l	0.50	0.71	< 0.50	1.0	0.75	0.55	< 0.50
Carbazole		N	1790	µg/l	0.50	13	< 0.50	14	8.3	1.1	< 0.50
Di-N-Butyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Fluoranthene		N	1790	µg/l	0.50	1.0	< 0.50	1.1	0.59	1.0	< 0.50
Pyrene		N	1790	µg/l	0.50	0.71	< 0.50	0.75	< 0.50	0.65	< 0.50
Butylbenzyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[a]anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chrysene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[b]fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[k]fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[a]pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[g,h,i]perylene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Nitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Phenols		U	1920	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030	< 0.030

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation	PL SW GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.	PL GW
1790	Semi-Volatile Organic Compounds (SVOCs) in Waters by GC-MS	Semi-volatile organic compounds	Solvent extraction / GCMS detection	
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
Uncertainty of measurement for the determinands tested are available upon request .
None of the results in this report have been recovery corrected.
All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated laboratory .
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.
All water samples will be retained for 14 days from the date of receipt.
Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	24-34371-1
Initial Date of Issue:	28-Oct-2024
Re-Issue Details:	
Client	E3P
Client Address:	Taylor Road Trafford Park Urmston Manchester M41 7JQ
Contact(s):	ndawson@e3p.co.uk
Project	Ryebank Fields Waters

Quotation No.:		**Date Received:**	23-Oct-2024
Order No.:	009813	**Date Instructed:**	23-Oct-2024
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	29-Oct-2024
Date Approved:	28-Oct-2024		

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Water

Project: Ryebank Fields Waters

Client: E3P				**Chemtest Job No.:**		24-34371	24-34371	24-34371	24-34371
Quotation No.:				**Chemtest Sample ID.:**		1884639	1884640	1884641	1884642
				Client Sample ID.:		CP201	CP202	CP203	CP204
				Sample Type:		WATER	WATER	WATER	WATER
				Sample Sub Type:					
				Date Sampled:		21-Oct-2024	21-Oct-2024	21-Oct-2024	21-Oct-2024
				Time Sampled:		12:00	12:00	12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**				
pH at 20C		U	1010		4.0	8.2	8.3	8.4	8.1
Cyanide (Total)		U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Calcium (Dissolved)		U	1455	mg/l	2.00	110	95	95	150
Arsenic (Dissolved)		U	1455	µg/l	0.20	1.8	11	3.8	2.0
Cadmium (Dissolved)		U	1455	µg/l	0.11	< 0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)		U	1455	µg/l	0.50	0.67	< 0.50	< 0.50	< 0.50
Copper (Dissolved)		U	1455	µg/l	0.50	0.96	0.92	0.92	0.68
Mercury (Dissolved)		U	1455	µg/l	0.05	0.05	< 0.05	< 0.05	< 0.05
Manganese (Dissolved)		U	1455	µg/l	0.50	110	390	220	630
Nickel (Dissolved)		U	1455	µg/l	0.50	1.3	1.3	0.76	1.9
Lead (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	1.6	< 0.50
Selenium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Zinc (Dissolved)		U	1455	µg/l	2.5	530	400	490	530
Dissolved Organic Carbon		U	1610	mg/l	2.0	3.8	44	22	38
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	170	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	170	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	0.84	< 0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	57	24	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	390	330	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	270	190	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	120	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	< 5.0	720	670	< 5.0
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	< 10	720	840	< 10
Dichlorodifluoromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane		U	1760	µg/l	5	< 5	< 5	< 5	< 5
Chloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Water

Project: Ryebank Fields Waters

Client: E3P				**Chemtest Job No.:**		24-34371	24-34371	24-34371	24-34371
Quotation No.:				**Chemtest Sample ID.:**		1884639	1884640	1884641	1884642
				Client Sample ID.:		CP201	CP202	CP203	CP204
				Sample Type:		WATER	WATER	WATER	WATER
				Sample Sub Type:					
				Date Sampled:		21-Oct-2024	21-Oct-2024	21-Oct-2024	21-Oct-2024
				Time Sampled:		12:00	12:00	12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**				
1,1-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane		U	1760	µg/l	5	< 5	< 5	< 5	< 5
Trichloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene		U	1760	µg/l	1.0	130	31	93	< 1.0
1,2-Dichloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Trichloroethene		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane		U	1760	µg/l	10	< 10	< 10	< 10	< 10
Bromodichloromethane		U	1760	µg/l	5	< 5	< 5	< 5	< 5
cis-1,3-Dichloropropene		N	1760	µg/l	10	< 10	< 10	< 10	< 10
Toluene		U	1760	µg/l	1.0	1.2	42	58	< 1.0
Trans-1,3-Dichloropropene		N	1760	µg/l	10	< 10	< 10	< 10	< 10
1,1,2-Trichloroethane		U	1760	µg/l	10	< 10	< 10	< 10	< 10
Tetrachloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane		U	1760	µg/l	10	< 10	< 10	< 10	< 10
1,2-Dibromoethane		U	1760	µg/l	5	< 5	< 5	< 5	< 5
Chlorobenzene		N	1760	µg/l	1.0	1.3	25	5.9	< 1.0
1,1,1,2-Tetrachloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene		U	1760	µg/l	1.0	1.6	21	60	< 1.0
m & p-Xylene		U	1760	µg/l	1.0	4.3	83	100	< 1.0
o-Xylene		U	1760	µg/l	1.0	4.0	51	35	< 1.0
Styrene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene		U	1760	µg/l	1.0	16	4.3	15	< 1.0
Bromobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	1760	µg/l	50	< 50	< 50	< 50	< 50
N-Propylbenzene		U	1760	µg/l	1.0	11	2.6	11	< 1.0
2-Chlorotoluene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		U	1760	µg/l	1.0	< 1.0	18	33	< 1.0
4-Chlorotoluene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		U	1760	µg/l	1.0	27	38	55	< 1.0

Results - Water

Project: Ryebank Fields Waters

Client: E3P				**Chemtest Job No.:**		24-34371	24-34371	24-34371	24-34371
Quotation No.:				**Chemtest Sample ID.:**		1884639	1884640	1884641	1884642
				Client Sample ID.:		CP201	CP202	CP203	CP204
				Sample Type:		WATER	WATER	WATER	WATER
				Sample Sub Type:					
				Date Sampled:		21-Oct-2024	21-Oct-2024	21-Oct-2024	21-Oct-2024
				Time Sampled:		12:00	12:00	12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**				
Sec-Butylbenzene		U	1760	µg/l	1.0	2.1	< 1.0	2.9	< 1.0
1,3-Dichlorobenzene		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	1760	µg/l	1.0	< 1.0	1.7	4.1	< 1.0
1,4-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		U	1760	µg/l	50	< 50	< 50	< 50	< 50
1,2,4-Trichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
N-Nitrosodimethylamine		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Phenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Chlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bis-(2-Chloroethyl)Ether		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,3-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,4-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,2-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Methylphenol (o-Cresol)		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Hexachloroethane		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Methylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Nitrobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Isophorone		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Nitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,4-Dimethylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50	3.9	< 0.50
Bis(2-Chloroethoxy)Methane		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,4-Dichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Naphthalene		N	1790	µg/l	0.50	1.9	27	130	< 0.50
4-Chloroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Hexachlorobutadiene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Methylnaphthalene		N	1790	µg/l	0.50	< 0.50	3.4	6.6	< 0.50
2,4,6-Trichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Chloronaphthalene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50

Results - Water

Project: Ryebank Fields Waters

Client: E3P				**Chemtest Job No.:**		24-34371	24-34371	24-34371	24-34371
Quotation No.:				**Chemtest Sample ID.:**		1884639	1884640	1884641	1884642
				Client Sample ID.:		CP201	CP202	CP203	CP204
				Sample Type:		WATER	WATER	WATER	WATER
				Sample Sub Type:					
				Date Sampled:		21-Oct-2024	21-Oct-2024	21-Oct-2024	21-Oct-2024
				Time Sampled:		12:00	12:00	12:00	12:00
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**				
Acenaphthylene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dimethylphthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,6-Dinitrotoluene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Acenaphthene		N	1790	µg/l	0.50	2.5	6.5	5.5	< 0.50
3-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dibenzofuran		N	1790	µg/l	0.50	1.0	2.2	2.5	< 0.50
4-Chlorophenylphenylether		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2,4-Dinitrotoluene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Fluorene		N	1790	µg/l	0.50	< 0.50	2.9	2.1	< 0.50
Diethyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Azobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Hexachlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Phenanthrene		N	1790	µg/l	0.50	1.2	3.1	2.8	< 0.50
Anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Carbazole		N	1790	µg/l	0.50	2.1	5.2	8.0	< 0.50
Di-N-Butyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Butylbenzyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[a]anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chrysene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[b]fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[k]fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[a]pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Benzo[g,h,i]perylene		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
4-Nitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Phenols		U	1920	mg/l	0.030	< 0.030	0.062	0.28	< 0.030

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation	PL SW GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.	PL GW
1790	Semi-Volatile Organic Compounds (SVOCs) in Waters by GC-MS	Semi-volatile organic compounds	Solvent extraction / GCMS detection	
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection
NEW-ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

DW - Drinking Water

Report Information

GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com