



High Speed Rail (West Midlands - Crewe)

Environmental Statement

Volume 5: Technical appendices

CA1: Fradley to Colton

Land quality report (LQ-001-001)



High Speed Rail (West Midlands - Crewe)

Environmental Statement

Volume 5: Technical appendices

CA1: Fradley to Colton

Land quality report (LQ-001-001)



Department
for Transport

High Speed Two (HS2) Limited has been tasked by the Department for Transport (DfT) with managing the delivery of a new national high speed rail network. It is a non-departmental public body wholly owned by the DfT.

High Speed Two (HS2) Limited,
Two Snowhill
Snow Hill Queensway
Birmingham B4 6GA

Telephone: 08081 434 434

General email enquiries: HS2enquiries@hs2.org.uk

Website: www.gov.uk/hs2

A report prepared for High Speed Two (HS2) Limited:

ARUP



High Speed Two (HS2) Limited has actively considered the needs of blind and partially sighted people in accessing this document. The text will be made available in full on the HS2 website. The text may be freely downloaded and translated by individuals or organisations for conversion into other accessible formats. If you have other needs in this regard, please contact High Speed Two (HS2) Limited.

© High Speed Two (HS2) Limited, 2017, except where otherwise stated.

Copyright in the typographical arrangement rests with High Speed Two (HS2) Limited.

This information is licensed under the Open Government Licence v2.0. To view this licence, visit www.nationalarchives.gov.uk/doc/open-government-licence/version/2 **OGL** or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or e-mail: psi@nationalarchives.gsi.gov.uk. Where we have identified any third-party copyright information you will need to obtain permission from the copyright holders concerned.



Printed in Great Britain on paper containing at least 75% recycled fibre.

Contents

1	Introduction	1
2	Engagement	2
3	Detailed risk assessment	3
3.1	Baseline risk assessment	6
3.2	Construction risk assessment	30
3.3	Post-construction risk assessment	54
3.4	Assessment of temporary (construction) and permanent (post-construction) effects	75
4	Geological sites of special scientific interest and local geological sites	88
5	Mining and minerals data	89
6	References	90

List of tables

Table 1:	Engagement on land quality issues undertaken for the Fradley to Colton area	2
Table 2:	Sites included in the detailed risk assessment within the Fradley to Colton area	3
Table 3:	CSM and qualitative risk assessment for landfill sites	6
Table 4:	1-239 Existing West Coast Main Line (WCML) railway	8
Table 5:	1-244 Dismantled mineral railway	10
Table 6:	1-240 Rugeley Power Station and fuel storage area	12
Table 7:	1-246 Coal mining pit heads and spoil mounds	14
Table 8:	Farm sites grouped - all located over the MSA sensitive receptor	16
Table 9:	1-219: Blythe Garage filling station (obsolete) on MSA receptor	18
Table 10:	1-136 Vehicle depot at Gorse Lane, Fradley	20
Table 11:	1-11 and 1-157: Kings Bromley Wharf and Marine service station	22
Table 12:	1-28 St James' Church graveyard and cemetery	24
Table 13:	1-42, 1-263 and 1-264 Infilled former pits and quarries	26
Table 14:	1-314 Business park and industrial estate	28
Table 15:	Landfill sites	30
Table 16:	1-239 Existing West Coast Main Line (WCML) railway	32
Table 17:	Dismantled mineral railway	34

Appendix LQ-001-001

Table 18: 1-240 Rugeley Power Station and fuel storage areas	36
Table 19: 1-246 Coal mining pit heads and spoil mounds	38
Table 20: Farm sites, all located over the MSA sensitive receptor	40
Table 21: 1-219 Blythe Garage filling station (obsolete) on MSA receptor	42
Table 22: 1-136 Vehicle depot at Gorse Lane, Fradley	44
Table 23: 1-11 and 1-157 Kings Bromley Wharf and Marine service station	46
Table 24: 1-28 St. James' Church graveyard and cemetery	48
Table 25: 1-42, 1-263 and 1-264 Infilled former pits and quarries	50
Table 26: 1-314 Business park and industrial estate	52
Table 27: Landfill sites	54
Table 28: 1-239 Existing West Coast Main Line (WCML) railway	56
Table 29: 1-244 Dismantled mineral railway	58
Table 30: 1-240 Rugeley Power Station and fuel storage area	59
Table 31: 1-246 Coal mining pit heads and spoil mounds	60
Table 32: Farms sites, all located over the MSA sensitive receptor	61
Table 33: 1-219: Blythe Garage filling station (obsolete) on MSA receptor	63
Table 34: 1-136 Vehicle depot at Gorse Lane, Fradley	65
Table 35: 1-1-11 and 1-157 Kings Bromley and Marine service station	67
Table 36: 1-28 St. James' Church graveyard and cemetery	69
Table 37: 1-42, 1-263 and 1-264 Infilled former pits and quarries	71
Table 38: 1-314 Business park and industrial estate	73
Table 39: Landfill sites	75
Table 40: 1-239 Existing West Coast Main Line (WCML) railway	77
Table 41: 1-244 Dismantled mineral railway line	78
Table 42: 1-240 Rugeley Power Station and fuel storage areas	79
Table 43: 1-246 Coal mining pit heads and spoil mounds	80
Table 44: Farm sites, all located over the MSA sensitive receptor	81
Table 45: 1-219 Blythe Garage filling station	82
Table 46: 1-136: Vehicle depot at Gorse Lane, Fradley	83
Table 47: 1-11 and 1-157 Kings Bromley Wharf and Marine service station	84
Table 48: 1-28 St. James' Church graveyard and cemetery	85
Table 49: 1-42, 1-263 and 1-264 Infilled former pits and quarries	86
Table 50: 1-314 Business park and industrial estate	87

1 Introduction

1.1.1 This document is an Appendix to the land quality assessment for the Fradley to Colton community area (CA1), it comprises:

- a summary of engagement undertaken (Section 2);
- detailed risk assessments (Section 3);
- geological sites of scientific interest (SSSI) and local geological sites (Section 4); and
- mining and minerals data (Section 5).

1.1.2 Maps referred to throughout this land quality Appendix are contained in the Volume 5 Land Quality Map Book (map references LQ-01-101 to LQ-01-105a).

2 Engagement

2.1.1 Table 1 sets out the local authorities and other organisations that have been engaged with during the preparation of the land quality section of the Environmental Statement for the Fradley to Colton area, the types of information that have been provided to the assessment team and any specific concerns of those engaged with.

Table 1: Engagement on land quality issues undertaken for the Fradley to Colton area

Local authority or other organisation	Method/ dates of contact	Information provided and/or specific concerns
British Geological Survey (BGS)	Meeting 23 February 2016	A meeting was held to discuss technical geological issues affecting the Proposed Scheme, including aquifer information (groundwater chemistry and vulnerability) and baseline methane levels in groundwater.
Staffordshire County Council (SCC)	Meeting 23 March 2016 Follow up call 5 January 2017	A meeting was held with the SCC Mineral Planning Policy Team to discuss the potential implications of the Proposed Scheme on policies contained in the Minerals Plans. SCC indicated that the then emerging Minerals Plan had been reviewed and would be submitted for approval on 2 February 2017. The Minerals Plan was subsequently adopted on 16 February 2017. There are no new areas of search identified in the Minerals Plan other than that at Kings Bromley. An 'area of search' refers to an area where the council recommends developers look for mineral resources. SCC also stated that three new minerals development planning applications had been made. All three applications lie outside the study area. SCC has been in discussion with HS2 regarding policy guidance on borrow pits. Provision for this has been made in Policy 1.6 of the Minerals Plan. In order to minimise traffic impact, it was advised that the location of the borrow pits be kept close to the route. SCC also indicated that there are no hydrocarbon planning applications within the study area. The GIS Officer and Minerals Planning Officers were contacted regarding contaminated land and landfill records as well as mineral resources.
Lichfield District Council (LDC)	Meeting 20 April 2016 Follow up call 10 January 2017	A meeting was held to discuss issues relating to contaminated land sites. A follow up call was made to LDC to establish if there were any reports or information regarding the power station site at Rugeley. No information was made available.
Environment Agency	Meeting 10 May 2016	A meeting was held to discuss water abstractions and groundwater resource sensitivity in relation to the Proposed Scheme. The Environment Agency provided information relating to recorded historical landfill sites within the study area and confirmed there were no SSSI (as defined in Part 2A of the Environmental Protection Act (1990) within the study area.
Food and Environment Research Agency (FERA)	16 May 2016	A meeting was held with stakeholder to discuss the locations of recorded foot and mouth disease (FMD) burial and pyre sites within the study area.

3 Detailed risk assessment

- 3.1.1 This section presents assessments for the higher risk potentially contaminated sites within the study area. For each site the following data is presented:
- baseline risk assessment;
 - construction risk assessment;
 - post-construction risk assessment; and
 - assessment of temporary (construction) and permanent (post-construction) effects.
- 3.1.2 A two stage screening process, stage A and stage B, has been carried out in accordance with the methodology set out in the Scope and Methodology Report (SMR) and its Addendum which are set out in Volume 5, Appendix CT-001-001 and CT-001-002. The SMR Addendum contains the Land Quality Technical Note: Detailed methodology for contaminated land assessment.
- 3.1.3 At each of the above stages professional judgement has been used to check that the screening process is highlighting significant sites.
- 3.1.4 For those sites which pass through stage B a further two stage detailed risk assessment (stages C and D) has been carried out in accordance with the methodology set out in the SMR.
- 3.1.5 The results of stage C are presented in three conceptual site models (CSM) as qualitative risk assessments covering baseline, construction and post-construction. The construction and post construction risk assessments assume that appropriate mitigation has been undertaken and that the operation of the railway is in accordance with environmental legislation.
- 3.1.6 Where nearby sites present a similar contamination risk, they can be grouped and considered together. This can be the case in the more urban areas where, for example, a light industrial estate may be considered as one site, rather than a number of individual sites. Similarly, in rural areas, small historical backfilled ponds and pits can be grouped together for assessment purposes.
- 3.1.7 Where sites have been grouped together, only one CSM has been prepared for those sites.
- 3.1.8 The sites assessed in this study area are set out in Table 2.

Table 2: Sites included in the detailed risk assessment within the Fradley to Colton area

Site reference	Name
1-22, 1-31, 1-32, 1-61, 1-123, 1-217, 1-247, 1-248, 1-249, 1-250, 1-251, 1-252, 1-253,	Landfill sites Rileyhill Farm landfill site, Landfill near Pipe Ridware, The Wharf Old Site, Potential refuse heap, Shaw Lane landfill site, N&H - Colton Hall Farm landfill site, North of Colton Hall Farm, Field No 7600 south of Colton Hall Farm, Landfill to the east of Power Station Road, Power Station Road landfill, Landfill site between Love Lane and Power Station Road, Historic landfill at Rugeley Power Station (1), Historical landfill at Rugeley Power Station (2)
1-239	Existing West Coast Main Line (WCML) railway

Appendix LQ-001-001

Site reference	Name
1- 244	Dismantled mineral railway
1- 240	Rugeley Power Station and fuel storage areas
1- 246	Coal mining pit heads and spoil mounds
1-9, 1-86,1-98, 1-120, 1-135, 1-139, 1-171, 1-183, 1-243, 1-236, 1-270, 1-271, 1-273, 1-274, 1-275, 1-276, 1-277, 1-280, 1-287, 1-289, 1-292, 1-293, 1-294, 1-295, 1-296, 1-297, 1-298, 1-299, 1-302, 1-303, 1-307, 1-312, 1-308, 1-317,	Farm sites Wharf Farm, Lount Farm, Hamley House Farm, Flint's Barn, Lodge Farm, Pool Farm, Woodshoot Farm, New Barn, Cawarden Springs Farm, Old Wood Farm, Common Farm Barn Farm extension, Shaw Barn, Hanch Hall Farm, Echills farm building, Glebe Farm, Shawlane Farm, Old Wood Farm No. 8, Hamley Cottage Farm, Bentley Hall Farm, Hall Farm, Church Farm Bromley Lane Farm Shaw Lane Farm, Wood End Barn, New Buildings Farm, Eastfields Farm, Bentley Hall Cottage, Colton Hall Farm, New House Farm, Rosewood Farm, Gorse Farm, Longley Barn, Oak Farm,
1-219	Blythe Garage filling station (obsolete)
1-136	Vehicle depot at Gorse Lane, Fradley
1- 11, 1-157	Kings Bromley Wharf and Marine Service Station
1- 28	St James' Church graveyard and cemetery
1-42, 1-263, 1-264	Infilled former pits and quarries
1-314	Business park and industrial estate

3.1.9 Contaminant types included within the risk assessments are based on the Department of the Environment, Farming and Rural Affairs (DEFRA) and Environment Agency (2002); Priority Contaminants Report CLR 8¹. Although this report has been withdrawn by the Environment Agency, there has been no subsequent authoritative replacement.

3.1.10 The remainder of this section presents the risk assessment for the sites going through to stages C and D of the assessment. These sites are shown on Maps LQ-01-101 to LQ-01-105a, (Volume 5: Land Quality Map Book).

3.1.11 The following abbreviations are used in these tables:

- VOC – volatile organic compound;
- BOD – biochemical oxygen demand;
- COD – chemical oxygen demand;
- PAH – polynuclear aromatic hydrocarbons;
- PCB – polychlorinated biphenyls;
- TPH – total petroleum hydrocarbons;
- MSA – mineral safeguarded areas; and

¹ Department for Environment, Food and Rural Affairs and Environment Agency (2002). *Potential Contaminants for the Assessment of Land*. R&D Publication CLR8

- FMD – foot and mouth disease.

3.1 Baseline risk assessment

Table 3: CSM and qualitative risk assessment for landfill sites

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
Soil, leachate, ground gas and groundwater contamination from historical landfills Potential for a range of organic and inorganic contaminants associated with household waste and potential colliery waste including, but not limited, to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH	On-site users - current	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Off-site users - residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Controlled waters - groundwater Principal aquifer of the Sherwood Sandstone group Secondary A aquifers of the superficial river terrace deposits Secondary B aquifers of the Mercia Mudstone group	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water River Trent, Trent and Mersey Canal	Lateral migration through groundwater Direct run-off from site	Likely	Minor	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Likely	Minor	Moderate/low

Description

The main characteristics of these sites are:

- the following landfills overlie the Principal aquifer of the Sherwood Sandstone group: 1-61 1-217, 1-249, 1-250, 1-251, 1-252, 1-253;
- the following landfills overlie the Secondary A aquifers of superficial river terrace deposits and MSA: 1-31, 1-217, 1-122, 1-123, 1-247, 1-249, 1-250, 1-251, 1-252 and 1-253;
- the following landfills fall within the land required for construction of the Proposed Scheme: 1-31, 1-32, 1-61, 1-217, 1-247, 1-248 1-250, 1-252 and 1-253;
- the following landfills are located next to a surface water feature (River Trent): 1-249, 1-250, 1-251, 1-252 and 1-253;
- the following landfill is located next to the Trent and Mersey Canal: 1-123;
- there is one authorised landfill within the land required for construction of the Proposed Scheme (1-127 N&H Colton Hall Farm landfill site);
- no details of the landfill construction, contents or licensing arrangements are known;
- authorised waste includes construction, demolition and dredging waste;
- Rugeley Power Station (1) and Rugeley Power Station (2) landfills are situated above the Principal aquifer, Secondary A aquifer and adjacent to the River Trent. They are also located within the MSA; and
- Environment Agency records for the landfills are supplied in Table 2 of the Environmental Statement Volume 2, Community area 1, Fradley to Colton report.

Table 4: 1-239 Existing West Coast Main Line (WCML) railway

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Potential for soil and groundwater contamination associated with an active railway</p> <p>Railway is on embankment, which may have been constructed using potentially contaminated fill materials including but not limited to heavy metals, sulphates, asbestos, PAH chlorinated solvents and PCB</p>	On-site users- railway workers, trespassers (assume rail passengers would not come into contact)	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Off-site users – residents at Cawarden Farm	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Controlled waters – groundwater – Principal aquifer and Secondary A aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Minor	Moderate/low
	Controlled waters - surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Likely	Minor	Moderate/low
	Property receptors – buildings, foundations and services (off-site)	Exposure to ground gases or vapours	Low likelihood	Minor	Low
Direct contact with contaminated soils and waters		Unlikely	Minor	Very low	

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of this site are:

- Railway Class 2, lies within Zone 1;
 - Situated above the bedrock Principal aquifer and the superficial geology Secondary A aquifer;
 - located within the MSA; and
 - Adjacent to the River Trent.
-

Table 5: 1-244 Dismantled mineral railway

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
Potential for soil and groundwater contamination associated with a historical railway. Potential contaminants include (but are not limited to) heavy metals, sulphates, asbestos, PAH chlorinated solvents, PCB	On-site users – staff and visitors at commercial units	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Off-site users – residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Controlled waters – groundwater - Principal aquifer and Secondary A aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Minor	Low
	Controlled waters - surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (on and off-site)	Exposure to vapours	Unlikely	Minor	Very low
Direct contact with contaminated soils and waters		Unlikely	Minor	Very low	

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation

Description

The main characteristics of this site are:

- there are superficial deposits in this area, which are classified as a Secondary A aquifer. The underlying bedrock is classified as a Principal aquifer;
 - located within the MSA;
 - the site is not located in a groundwater protection zone; and
 - it is assumed that ground contamination associated with the railway remains in situ. No evidence to date regarding any remediation prior to the construction of the current commercial units, where the units exist along part of the dismantled mineral railway.
-

Table 6: 1-240 Rugeley Power Station and fuel storage area

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, ground gas and groundwater contamination from power station operations and fuel storage area</p> <p>Potential for a range of organic and inorganic contaminants associated with the power station including but not limited, to heavy metals, PCBs, inorganics ammonia, asbestos, ground gases (methane, carbon dioxide, hydrogen sulphide) and organics such as PAH and heavy fuel oils</p>	On-site users - staff and visitors to site	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Low likelihood	Minor	Low
	Off-site users - residential more than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater - Principal aquifer and secondary A aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent and Trent and Mersey canal	Lateral migration through groundwater Direct run-off from site	Likely	Medium	Moderate
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
Direct contact with contaminated soils and waters		Low likelihood	Medium	Moderate/low	

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of this site are:

- there are superficial deposits in this area, which are classified as a Secondary A aquifer. The underlying bedrock is classified as a Principal aquifer;
 - located within the MSA;
 - located between the River Trent and Trent and Mersey canal; and
 - the site is not located in a groundwater protection zone.
-

Table 7: 1-246 Coal mining pit heads and spoil mounds

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, ground gas and groundwater contamination from historical colliery</p> <p>Potential for a range of organic and inorganic contaminants associated with coal mining including but not limited, to heavy metals, inorganics, organics such as PAH and ground gases (methane, carbon dioxide)</p>	On-site users – current site users, staff and visitors	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Low likelihood	Minor	Low
	Off-site users - residential more than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater - Principal aquifer and Secondary A aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water River Trent and the Trent and Mersey Canal	Lateral migration through groundwater Direct run-off from site	Likely	Medium	Moderate
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of this site are:

- there are superficial deposits in this area, which are classified as a Secondary A aquifer. The underlying bedrock is classified as a Principal aquifer
 - located on the MSA;
 - located between the River Trent and the Trent and Mersey Canal; and
 - the site is not located in a groundwater protection zone.
-

Table 8: Farm sites grouped - all located over the MSA sensitive receptor

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil and groundwater contamination resulting from leaks and spills of liquids and solids, use of agricultural chemicals and burial of animal remains</p> <p>May include diesel fuel, lubricating oils, solvents, slurry and agricultural chemicals such as pesticides and herbicides, pathogens</p> <p>Potential for a range of organic and inorganic contaminants including but not limited to hydrocarbons (diesel range, lubricating oils, solvents), ammonia, elevated BOD, elevated COD, pesticides, herbicides, FMD and anthrax</p>	On-site users – farm occupants, farm workers, livestock	Direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Likely	Medium	Moderate
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Likely	Medium	Moderate
		Inhalation of gases and vapours	Low likelihood	Medium	Moderate/low
	Off-site users – residential, surrounding farmland	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of gases and vapours	Unlikely	Medium	Low
	Controlled waters – groundwater within the sand and gravel MSA (Secondary A aquifer); Sherwood Sandstone Principal aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent, Trent and Mersey Canal and a series of tertiary rivers)	Lateral migration through groundwater Direct run-off from site	Likely	Medium	Moderate
	Property receptors – buildings, foundations and services (off-site)	Exposure to gases and vapours	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Unlikely	Medium	Low

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of these sites are:

- all farms in this group are located over the MSA;
 - the superficial deposits (MSA) are classified as a Secondary A aquifer;
 - Hanch Hall Farm is located within a groundwater protection zone;
 - Shaw lane Farm is the closest site to the Proposed Scheme;
 - Echills Farm is approximately 150m north of Borrow Pit 191. There is a potential for the worsening of groundwater quality as a result of dewatering activities during operation of the borrow pits which may draw contaminated groundwater from sources; and
 - assumes off site receptors may be at risk during ploughing or other ground disturbance, or application of chemicals.
-

Table 9: 1-219: Blythe Garage filling station (obsolete) on MSA receptor

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil and groundwater contamination from former petrol station/garage</p> <p>Potential for a range of organic contaminants (fuels, oils) that contain petroleum hydrocarbons, BTEX, naphthalene, fuel additives, VOCs, PAHs and phenols</p> <p>Other potential contaminants include acids, asbestos and phosphates</p>	On-site users – current use is cricket ground	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Low likelihood	Medium	Moderate/low
	Off-site users – residential and school	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Unlikely	Medium	Low
	Controlled waters – groundwater Secondary A aquifers of the superficial river terrace deposits MSA	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent and Crawley Brook	Lateral migration through groundwater Direct run-off from site	Low likelihood	Medium	Moderate/low
	Property receptors – buildings, foundations and services (off-site)	Exposure to vapours	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of this site are:

- there are superficial deposits in this area, which are classified as a Secondary A aquifer. The underlying bedrock is classified as a Secondary B aquifer;
 - the site is not located in a groundwater protection zone; and
 - the site is located on the MSA.
-

Table 10: 1-136 Vehicle depot at Gorse Lane, Fradley

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, ground gas and groundwater contamination from vehicle depot (fuel and oil storage)</p> <p>Potential for a range of organic and inorganic contaminants associated with vehicle depots including but not limited, to heavy metals, inorganics, organics such as PAH, TPH and ground gases (methane, carbon dioxide)</p>	On-site users – on-site workers and visitors	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Off-site users – residential (potential occupants on Gorse Farm approximately 150m east of site)	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters - groundwater Secondary B aquifers of the superficial river terrace deposits and the bedrock Mercia Mudstone group	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - Trent and Mersey Canal	Lateral migration through groundwater Direct run-off from site	Low likelihood	Medium	Moderate/low
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of this site are:

- the underlying bedrock is classified as a Secondary B aquifer;
 - located less than 100m from the Trent and Mersey Canal
 - the site is not located in a groundwater protection zone; and
 - the details of the drainage system at the site are unknown.
-

Table 11: 1-11 and 1-157: Kings Bromley Wharf and Marine service station

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, ground gas and groundwater contamination from industrial activities at the wharf</p> <p>Potential for a range of organic and inorganic contaminants associated with on-site workshops and scrap waste storage at the wharf, including but not limited to heavy metals, hydrocarbons, TPH, PAHs and ground gases (methane, carbon dioxide)</p>	On-site users –workers and users of the Kings Bromley Wharf and the Marine Service Station	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases.	Low likelihood	Severe	Moderate
	Off-site users - residential properties less than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters -groundwater Secondary A aquifers – Glaciofluvial Sand and Gravel MSA	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – Trent and Mersey Canal and adjoining Kings Bromley Wharf and Marine Service Station	Lateral migration through groundwater Direct run-off from site	Low likelihood	Medium	Moderate/low
	Property receptors – potential buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/ low
		Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of this site are:

- there are superficial deposits in this area, which are classified as a Secondary A aquifer. The underlying bedrock is classified as a Secondary B aquifer;
 - the site is not located in a groundwater protection zone; and
 - the site is located above the MSA.
-

Table 12: 1-28 St James' Church graveyard and cemetery

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
Soil, leachate and groundwater contamination from burials Potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, formaldehyde, nutrients and pathogens	On-site users - St James' Church users and members of the public accessing the graveyard area	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Off-site users - agricultural workers and residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters – groundwater - Secondary A superficial aquifer – river terrace deposits, MSA	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – River Trent	Lateral migration through groundwater Direct run-off from site	Unlikely	Medium	Low
	Property receptors – buildings, foundations and services - (St James' Church on-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of this site are:

- there are superficial deposits in this area, which are classified as a Secondary A aquifer. The underlying bedrock is classified as a Secondary B aquifer;
 - located above the MSA; and
 - the site is not located in a groundwater protection zone.
-

Table 13: 1-42, 1-263 and 1-264 Infilled former pits and quarries

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
Soil, leachate, ground gas and groundwater contamination from potential historical infill Potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH	On site users – residential, general public and passers-by	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Off-site users - residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters – groundwater Secondary B aquifer (Mercia Mudstone group) Secondary A superficial aquifer (alluvium - clay, silt, sand and gravel)	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Minor	Moderate / low
	Controlled waters - surface water – River Trent, adjoining tributaries	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
Direct contact with contaminated soils and waters		Unlikely	Minor	Very low	

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of this site are:

- there are superficial deposits in this area, which are classified as a Secondary A aquifer. The underlying bedrock is classified as a Secondary B aquifer;
 - 1-42 and 1-263 are located on a MSA;
 - 1-264 is partially located on a MSA;
 - 1-263 and 1-264 are located 150m from the River Trent at the nearest point; and the sites are not located in a groundwater protection zone.
-

Table 14: 1-314 Business park and industrial estate

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
<p>Soil, leachate, ground gas and groundwater contamination from business parks and industrial estates (fuel and oil storage)</p> <p>Potential for a range of organic and inorganic contaminants associated with business parks and industrial estates including but not limited, to heavy metals, inorganics, organics such as PAH, TPH and ground gases (methane, carbon dioxide)</p>	On-site users – on-site workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low risk
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low risk
		Inhalation of ground gases	Unlikely	Severe	Moderate/low risk
	Off-site users – residential properties (potential occupants at Gorse Farm)	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters - groundwater Secondary A aquifers of the superficial river terrace deposits and Secondary B aquifers of the bedrock Mercia Mudstone group	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters - surface water Trent and Mersey Canal	Lateral migration through groundwater Direct run-off from site	Unlikely	Medium	Low
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
Direct contact with contaminated soils and waters		Low likelihood	Medium	Moderate/low	

Source	Receptor	Pathway	Probability	Consequence	Risk at baseline without mitigation
--------	----------	---------	-------------	-------------	-------------------------------------

Description

The main characteristics of this site are:

- there are superficial deposits in this area, which are classified as a Secondary A aquifer. The underlying bedrock is classified as a Secondary B aquifer;
 - the site is located on the MSA; and
 - the site is not located in a groundwater protection zone.
-

3.2 Construction risk assessment

Table 15: Landfill sites

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil, leachate, ground gas and groundwater contamination from historical landfills</p> <p>Potential for a range of organic and inorganic contaminants associated with household waste and potential colliery waste including, but not limited, to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH</p>	On-site users - current	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Off-site users - residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Controlled waters - groundwater - Principal Aquifer of the Sherwood Sandstone group Secondary A aquifers of the superficial river terrace deposits Secondary B aquifers of the Mercia Mudstone group	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent, Trent and Mersey Canal	Lateral migration through groundwater Direct run-off from site	Likely	Minor	Moderate/Low
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Likely	Minor	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
--------	----------	---------	-------------	-------------	-----------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft Code of Construction Practice² (CoCP). Construction workers have been excluded from assessment due to the use of personal protective equipment (PPE)/risk management protocols and in accordance with the Land quality Technical Note in the SMR Addendum (Volume 5: Appendix CT-001-002);
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas, e.g. from directional drilling potentially through landfill material. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline;
- ground investigation will be required prior to investigation;
- historical infill exists without any lining, impermeable capping or leachate control systems in place;
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline; and
- pylons associated with overhead power lines may intersect landfill sites (e.g. N&H Colton Hall Landfill).

² Draft Code of Construction Practice, Volume 5: Appendix CT-003-000

Table 16: 1-239 Existing West Coast Main Line (WCML) railway

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
Potential for soil and groundwater contamination associated with an active railway line including but not limited to heavy metals, sulphates, asbestos, PAH chlorinated solvents and PCB	On-site users - railway workers, trespassers (assume rail passengers would not come into contact)	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Off-site users – residents at Cawarden Farm more than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Controlled waters - groundwater - Principal aquifer and Secondary A aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Minor	Moderate/low
	Controlled waters - surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Likely	Minor	Moderate/low
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Unlikely	Minor	Very low
Direct contact with contaminated soils and waters		Low likelihood	Minor	Low	

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
--------	----------	---------	-------------	-------------	-----------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

Table 17: Dismantled mineral railway

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
Potential for soil and groundwater contamination associated with a historical railway line including but not limited to heavy metals, sulphates, asbestos, PAH chlorinated solvents and PCB	On-site users – staff and visitors at commercial units	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Off-site users – residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Controlled waters – groundwater - Principal aquifer and Secondary A aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Minor	Very low
	Controlled waters - surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very Low
	Property receptors – buildings, foundations and services (off-site)	Exposure to ground gases or vapours	Unlikely	Minor	Very low
		Direct contact with contaminated soils and waters	Unlikely	Minor	Very low

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
 - assumes that residual material will not be disturbed during HS2 construction works;
 - during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
 - whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
 - assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.
-

Table 18: 1-240 Rugeley Power Station and fuel storage areas

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil, leachate, ground gas and groundwater contamination from power station operations and fuel storage area</p> <p>Potential for a range of organic and inorganic contaminants associated with the power station including but not limited to Heavy metals, PCBs, inorganics ammonia, asbestos, ground gases (methane, carbon dioxide, hydrogen sulphide) and organics such as PAH and heavy fuel oils</p>	On-site users - staff and visitors to site	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Low likelihood	Minor	Low
	Off-site users – residential more than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater - Principal aquifer and secondary A aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent and Trent and Mersey canal	Lateral migration through groundwater Direct run-off from site	Likely	Medium	Moderate
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
--------	----------	---------	-------------	-------------	-----------------------------------------

Notes / assumptions

- assumes further site remediation not required as part of Proposed Scheme;
- also assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

Table 19: 1-246 Coal mining pit heads and spoil mounds

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil, leachate, ground gas and groundwater contamination from historical colliery</p> <p>Potential for a range of organic and inorganic contaminants associated with coal mining including but not limited, to heavy metals, inorganics, organics such as PAH and ground gases (methane, carbon dioxide)</p>	On-site users – current site users, staff and visitors	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Low likelihood	Minor	Low
	Off-site users – residential more than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters – groundwater - Principal aquifers	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Likely	Medium	Moderate
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
--------	----------	---------	-------------	-------------	-----------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

Table 20: Farm sites, all located over the MSA sensitive receptor

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil and groundwater contamination resulting from leaks and spills of liquids and solids, use of agricultural chemicals, burial of animal remains</p> <p>May include diesel fuel, lubricating oils, solvents, slurry and agricultural chemicals such as pesticides and herbicides, pathogens</p> <p>Potential for a range of organic and inorganic contaminants including but not limited to hydrocarbons (diesel range, lubricating oils, solvents), ammonia, elevated BOD, elevated COD, pesticides, herbicides, FMD and anthrax</p>	On-site users – farm occupants, occasional farm workers and livestock	Direct contact, ingestion of dusts and vapours from contaminated soils	Likely	Medium	Moderate
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Likely	Medium	Moderate
		Inhalation of gases and vapours	Low likelihood	Medium	Moderate/low
	Off-site users – residential and surrounding farmland	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of gases and vapours	Unlikely	Medium	Low
	Controlled waters – groundwater within the sand and gravel MSA (Secondary A aquifer); Sherwood Sandstone Principal aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent, Trent and Mersey Canal and a series of tertiary rivers	Lateral migration through groundwater Direct run-off from site	Likely	Medium	Moderate
	Property receptors – buildings, foundations and services (off-site)	Exposure to gases and vapours	Unlikely	Severe	Moderate/low
Direct contact with contaminated soils and waters		Unlikely	Medium	Low	

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
--------	----------	---------	-------------	-------------	-----------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline;
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline. Echills Farm is approximately 150m north of Borrow Pit 191. There is a potential for the worsening of groundwater quality as a result of dewatering activities during operation of the borrow pits which may draw contaminated groundwater from sources;
- 1-295 is in closest proximity to the Proposed Scheme; and
- 1-275 is approximately 150m north of Borrow Pit 191. There is a potential for the worsening of groundwater quality as a result of dewatering activities during operation of the borrow pits which may draw contaminated groundwater from sources.

Table 21: 1-219 Blythe Garage filling station (obsolete) on MSA receptor

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil and groundwater contamination from former petrol station/garage</p> <p>Potential for a range of organic contaminants (fuels, oils) that contain petroleum hydrocarbons, BTEX, naphthalene, fuel additives, VOCs, PAHs and phenols</p> <p>Other potential contaminants include acids, asbestos and phosphates</p>	On-site users – current use as cricket ground	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Low likelihood	Medium	Moderate/low
	Off-site users – residential and school	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Unlikely	Medium	Low
	Controlled waters – groundwater - Secondary A aquifers of the superficial river terrace deposits MSA	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent and Crawley Brook	Lateral migration through groundwater Direct run-off from site	Low likelihood	Medium	Moderate/low
	Property receptors – buildings, foundations and services (off-site)	Exposure to vapours	Unlikely	Severe	Moderate/low
Direct contact with contaminated soils and waters		Unlikely	Negligible	Very low	

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
--------	----------	---------	-------------	-------------	-----------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

Table 22: 1-136 Vehicle depot at Gorse Lane, Fradley

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
Soil, leachate, ground gas and groundwater contamination from vehicle depot Potential for a range of organic and inorganic contaminants associated with coal mining including but not limited, to heavy metals, inorganics, organics such as PAH, TPH and ground gases (methane, carbon dioxide)	On-site users – on-site workers and visitors	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Low likelihood	Minor	Low
	Off-site users – residential (potential occupants on Gorse Farm approximately 150m east of site)	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Negligible	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Negligible	Very low
		Inhalation of ground gases	Low likelihood	Negligible	Very low
	Controlled waters - groundwater Secondary B aquifers of the superficial river terrace deposits and the bedrock Mercia Mudstone group	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - Trent and Mersey Canal	Lateral migration through groundwater Direct run-off from site	Low likelihood	Medium	Moderate/low
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
--------	----------	---------	-------------	-------------	-----------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

Table 23: 1-11 and 1-157 Kings Bromley Wharf and Marine service station

Source	Receptor	Pathway	Probability	Consequence	Risk at construction stage mitigation
<p>Soil, leachate, ground gas and groundwater contamination from industrial activities at the wharf</p> <p>Potential for a range of organic and inorganic contaminants associated with on-site workshops and scrap waste storage at the wharf, including but not limited to heavy metals, hydrocarbons and ground gases (methane, carbon dioxide)</p>	On-site users –workers and users of the Kings Bromley Wharf and the Marine Service Station	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Off-site users - residential properties less than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters - groundwater - Secondary A aquifers - glaciofluvial sand and gravel MSA	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – Trent and Mersey Canal and adjoining Kings Bromley Wharf and Marine Service Station	Lateral migration through groundwater Direct run-off from site	Low likelihood	Medium	Moderate/low
	Property receptors – potential buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/ low
		Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Source	Receptor	Pathway	Probability	Consequence	Risk at construction stage mitigation
--------	----------	---------	-------------	-------------	---------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual landfill material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

Table 24: 1-28 St. James' Church graveyard and cemetery

Source	Receptor	Pathway	Probability	Consequence	Risk at construction stage mitigation
Soil, leachate and groundwater contamination from burials Potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, formaldehyde, nutrients and pathogens	On-site users - St James' Church users and members of the public accessing the site	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Off-site users - agricultural workers and residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters – groundwater - Secondary A superficial aquifer – river terrace deposits	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very low
	Property receptors – buildings, foundations and services - (St James' Church on-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
Direct contact with contaminated soils and waters		Unlikely	Negligible	Very low	

Source	Receptor	Pathway	Probability	Consequence	Risk at construction stage mitigation
--------	----------	---------	-------------	-------------	---------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
- assumed dewatering during construction could draw contamination into the groundwater causing a temporary worsening in groundwater quality compared to baseline conditions.

Table 25:1-42, 1-263 and 1-264, Infilled former pits and quarries

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
Soil, leachate, ground gas and groundwater contamination from potential historic infill Potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH	On-site users – residential, general public and passers-by	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Off-site users - residential,	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters – Groundwater - Principal bedrock aquifer (Sherwood Sandstone group) Secondary A superficial aquifer (alluvium - clay, silt, sand and gravel)	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Minor	Moderate/low
	Controlled waters - surface water – River Trent and adjoining tributaries	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Low likelihood	Minor	Low

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
--------	----------	---------	-------------	-------------	-----------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

Table 26: 1-314 Business park and industrial estate

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
<p>Soil, leachate, ground gas and groundwater contamination from business parks and industrial estates (fuel and oil storage)</p> <p>Potential for a range of organic and inorganic contaminants associated with business parks and industrial estates including but not limited, to heavy metals, inorganics, organics such as PAH, TPH and ground gases (methane, carbon dioxide)</p>	On-site users – on- site workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Off-site users – residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Negligible	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Negligible	Very low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters - groundwater - Secondary A aquifers of the superficial river terrace deposits and Secondary B aquifers of the bedrock Mercia Mudstone group	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters - surface water Trent and Mersey Canal	Lateral migration through groundwater Direct run-off from site	Unlikely	Medium	Low
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate /low

Source	Receptor	Pathway	Probability	Consequence	Risk with construction stage mitigation
--------	----------	---------	-------------	-------------	-----------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works;
- during construction standard mitigation procedures are assumed to be implemented in accordance with the draft CoCP. Construction workers have been excluded from assessment due to the use of PPE / risk management protocols;
- whilst the draft CoCP will make it unlikely that there will be adverse consequences associated with construction e.g. the control of surface runoff and dust, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The adoption of the draft CoCP generally results in a low to unlikely probability of a consequence, but in some cases the actual consequence may temporarily increase from that defined at baseline; and
- assumed dewatering during construction could draw contamination into the groundwater, causing a temporary worsening in groundwater quality compared to baseline.

3.3 Post-construction risk assessment

Table 27: Landfill sites

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Soil, leachate, ground gas and groundwater contamination from historical landfills</p> <p>Potential for a range of organic and inorganic contaminants associated with household waste and potential colliery waste including, but not limited, to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH</p>	On-site users - current	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium/low	Moderate/low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Off-site users - residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Controlled waters - groundwater - Principal aquifer of the Sherwood Sandstone group Secondary A aquifers of the superficial river terrace 1 and river terrace 2 deposits Secondary B Aquifers of the Mercia Mudstone group	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water River Trent, Trent and	Lateral migration through groundwater Direct run-off from site	Likely	Minor	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
	Mersey Canal				
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Likely	Minor	Moderate/low

Notes / assumptions

- construction area required for the grid connection will encroach on approximately half of the following landfills: 1-217, 1-247, 1-248;
- assumes baseline conditions will not change at post construction due to zone 2- zone 3 location;
- a range may be given as remediation strategies will vary in design to focus on specific contaminative risks at each site. Remediation strategies may involve source removal or pathway intervention as appropriate;
- assumes remediation required has been undertaken and construction works are complete. No pathways are left open; and
- on-site users' excludes rail passengers (as whilst within trains, will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 28: 1-239 Existing West Coast Main Line (WCML) railway

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Potential for soil and groundwater contamination associated with an active railway</p> <p>Railway is on embankment, which may have been constructed using potentially contaminated fill materials including but not limited to heavy metals, sulphates, PAH, chlorinated solvents and PCB</p>	On-site users – railway workers, trespassers (assume rail passengers would not come into direct contact)	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Off-site users – Residents at Cawarden Farm	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Controlled waters – groundwater – Principal aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Minor	Moderate/low
	Controlled waters - surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Likely	Minor	Moderate/low
	Property receptors – buildings, foundations and services (off-site)	Exposure to ground gases or vapours	Unlikely	Minor	Very low
		Direct contact with contaminated soils and waters	Low likelihood	Minor	Low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
--------	----------	---------	-------------	-------------	--------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- on-site users' excludes rail passengers (whilst within trains as they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 29: 1-244 Dismantled mineral railway

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
Potential for soil and groundwater contamination associated with a historical railway including but not limited to heavy metals, sulphates, asbestos, PAH, chlorinated solvents and PCB	On-site users – commercial units	Direct contact, ingestion of dusts and vapours from contaminated soils	Low Likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low Likelihood	Minor	Low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Off-site users – residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Minor	Very low
	Controlled waters – groundwater Principal aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Minor	Low
	Controlled waters - surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site)	Exposure to ground gases or vapours	Unlikely	Minor	Very low
		Direct contact with contaminated soils and waters	Unlikely	Minor	Very low

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- also assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (as whilst within trains, will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 30: 1-240 Rugeley Power Station and fuel storage area

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Soil, leachate, ground gas and groundwater contamination from Power station operations and fuel storage area</p> <p>Potential for a range of organic and inorganic contaminants associated with the power station including but not limited, to heavy metals, PCBs, inorganics ammonia, asbestos, ground gases (methane, carbon dioxide, hydrogen sulphide) and organics such as PAH and heavy fuel oils</p>	On-site users - current	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Low likelihood	Minor	Low
	Off-site users – residential more than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters - groundwater - Principal aquifers	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Likely	Medium	Moderate
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
Direct contact with contaminated soils and waters		Low likelihood	Medium	Moderate/low	

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (whilst within trains they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 31: 1-246 Coal mining pit heads and spoil mounds

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
Soil, leachate, ground gas and groundwater contamination from historical colliery Potential for a range of organic and inorganic contaminants associated with coal mining including but not limited, to heavy metals, inorganics, organics such as PAH and ground gases (methane, carbon dioxide)	On-site users - current	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Low likelihood	Minor	Low
	Off-site users – residential more than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Low likelihood	Medium	Moderate/low
	Controlled waters - groundwater - Principal aquifers	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Likely	Medium	Moderate
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
Direct contact with contaminated soils and waters		Low likelihood	Medium	Moderate/low	

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (whilst within trains they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 32: Farms sites, all located over the MSA sensitive receptor

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Soil and groundwater contamination resulting from leaks and spills of liquids and solids, use of agricultural chemicals, burial of animal remains</p> <p>May include diesel fuel, lubricating oils, solvents, slurry and agricultural chemicals such as pesticides and herbicides, pathogens</p> <p>Potential for a range of organic and inorganic contaminants including but not limited to hydrocarbons (diesel range, lubricating oils, solvents), ammonia, elevated BOD, elevated COD, pesticides, herbicides, FMD and anthrax</p>	On-site users – farm occupants, occasional farm workers and livestock	Direct contact, ingestion of dusts and vapours from contaminated soils	Likely	Medium	Moderate
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Likely	Medium	Moderate
		Inhalation of gases and vapours	Low likelihood	Medium	Moderate/low
	Off-site users – residential and surrounding farmland	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of gases and vapours	Unlikely	Medium	Low
	Controlled waters – groundwater within the sand and gravel MSA (Secondary A aquifer); Sherwood Sandstone Principal aquifer	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent, Trent and Mersey Canal and a series of tertiary rivers	Lateral migration through groundwater Direct run-off from site	Likely	Medium	Moderate
	Property receptors – buildings, foundations and services (off-site)	Exposure to gases and vapours	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Unlikely	Medium	Low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
--------	----------	---------	-------------	-------------	--------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (whilst within trains they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 33: 1-219: Blythe Garage filling station (obsolete) on MSA receptor

Source	Receptor	Pathway	Probability	Consequence	Risks with permanent works mitigation
<p>Soil and groundwater contamination from former petrol station/garage</p> <p>Potential for a range of organic contaminants (fuels, oils) that contain petroleum hydrocarbons, BTEX, naphthalene, fuel additives, VOCs, PAHs and phenols</p> <p>Other potential contaminants include acids, asbestos, and phosphates</p>	On-site users – current use as cricket ground	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Low likelihood	Medium	Moderate/low
	Off-site users – residential and school	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of vapours (volatile substances)	Unlikely	Medium	Low
	Controlled waters – groundwater - Secondary A aquifers of the superficial river terrace deposits MSA	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - River Trent and Crawley Brook	Lateral migration through groundwater Direct run-off from site	Low likelihood	Medium	Moderate/low
	Property receptors – buildings, foundations and services (off-site)	Exposure to vapours	Unlikely	Severe	Moderate/low
Direct contact with contaminated soils and waters		Unlikely	Negligible	Very low	

Source	Receptor	Pathway	Probability	Consequence	Risks with permanent works mitigation
--------	----------	---------	-------------	-------------	---------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (whilst within trains they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 34: 1-136 Vehicle depot at Gorse Lane, Fradley

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Soil, leachate, ground gas and groundwater contamination from vehicle depot</p> <p>Potential for a range of organic and inorganic contaminants associated with coal mining including but not limited, to heavy metals, inorganics, organics such as PAH, TPH and ground gases (methane, carbon dioxide)</p>	On-site users – on- site workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Off-site users – residential (potential occupants on Gorse Farm approximately 150m east of site)	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters - groundwater - Secondary B aquifers of the superficial river terrace Deposits and the bedrock Mercia Mudstone group	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Medium	Moderate
	Controlled waters - surface water - Trent and Mersey Canal	Lateral migration through groundwater Direct run-off from site	Low likelihood	Medium	Moderate/low
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
--------	----------	---------	-------------	-------------	--------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (whilst within trains they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 35: 1-1-11 and 1-157 Kings Bromley and Marine service station

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Soil, leachate, ground gas and groundwater contamination from industrial activities at the wharf</p> <p>Potential for a range of organic and inorganic contaminants associated with on-site workshops and scrap waste storage at the wharf, including but not limited to heavy metals, hydrocarbons, and ground gases (methane, carbon dioxide)</p>	On-site users – workers and users of the Kings Bromley Wharf and the Marine Service Station	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Low likelihood	Severe	Moderate
	Off-site users - residential properties more than 150m away	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Medium	Low
	Controlled waters - groundwater - Secondary A aquifers – glaciofluvial sand and gravel MSA	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – surface water -Trent and Mersey Canal and adjoining Kings Bromley Wharf and Marine Service Station	Lateral migration through groundwater Direct run-off from site	Low likelihood	Medium	Moderate/low
	Property receptors – potential buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
--------	----------	---------	-------------	-------------	--------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (whilst within trains they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 36: 1-28 St. James' Church graveyard and cemetery

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
Soil, leachate and groundwater contamination from burials Potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, formaldehyde, nutrients and pathogens	On-site users - St James' Church users and members of the public accessing the site	Direct contact, ingestion of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Severe	Moderate
	Off-site users - agricultural workers and residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Medium	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Medium	Low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters – groundwater -Secondary A superficial aquifer – river terrace deposits	Leaching, vertical and lateral migration from contaminated soils and waters	Low likelihood	Medium	Moderate/low
	Controlled waters – surface water - River Trent	Lateral migration through groundwater Direct run-off from site	Unlikely	Minor	Very low
	Property receptors – buildings, foundations and services - (St James' Church on-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
		Direct contact with contaminated soils and waters	Unlikely	Negligible	Very low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
--------	----------	---------	-------------	-------------	--------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (whilst within trains they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 37: 1-42, 1-263 and 1-264, Infilled former pits and quarries

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
Soil, leachate, ground gas and groundwater contamination from potential historic infill Potential for a range of organic and inorganic contaminants including but not limited to heavy metals, ammonia, ground gases (methane, carbon dioxide) and organics such as PAH	On-site users - residential, general public and passers-by	Direct contact, ingestion of dusts and vapours from contaminated soils	Low likelihood	Minor	Low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Minor	Low
		Inhalation of ground gases	Unlikely	Severe	Moderate/ low
	Off-site users - residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters – groundwater Principal bedrock aquifer (Sherwood Sandstone group) Secondary A superficial aquifer (alluvium - clay, silt, sand and gravel)	Leaching, vertical and lateral migration from contaminated soils and waters	Likely	Minor	Moderate/low
	Controlled waters - surface water – River Trent and adjoining tributaries	Lateral migration through groundwater Direct run-off from site	Low likelihood	Minor	Low
	Property receptors – buildings, foundations and services (off-site)	Exposure to explosive gases	Unlikely	Severe	Moderate/low
Direct contact with contaminated soils and waters		Unlikely	Minor	Very low	

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
--------	----------	---------	-------------	-------------	--------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (whilst within trains they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

Table 38: 1-314 Business park and industrial estate

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
<p>Soil, leachate, ground gas and groundwater contamination from business parks and industrial estates (fuel and oil storage)</p> <p>Potential for a range of organic and inorganic contaminants associated with business parks and industrial estates including but not limited, to heavy metals, inorganics, organics such as PAH, TPH and ground gases (methane, carbon dioxide)</p>	On-site users – on- site workers	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Low likelihood	Medium	Moderate/low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Low likelihood	Medium	Moderate/low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Off-site users – residential	Direct contact, ingestion, inhalation of dusts and vapours from contaminated soils	Unlikely	Minor	Very low
		Direct contact, ingestion, inhalation of vapours from contaminated waters	Unlikely	Minor	Very low
		Inhalation of ground gases	Unlikely	Severe	Moderate/low
	Controlled waters - groundwater -Secondary A aquifers of the superficial river terrace deposits and Secondary B aquifers of the bedrock Mercia Mudstone group	Leaching, vertical and lateral migration from contaminated soils and waters	Unlikely	Medium	Low
	Controlled waters - surface water - Trent and Mersey Canal	Lateral migration through groundwater Direct run-off from site	Unlikely	Medium	Low
	Property receptors – buildings, foundations and services (on-site and off-site)	Exposure to explosive gases	Low likelihood	Severe	Moderate
		Direct contact with contaminated soils and waters	Low likelihood	Medium	Moderate/low

Source	Receptor	Pathway	Probability	Consequence	Risk with permanent works mitigation
--------	----------	---------	-------------	-------------	--------------------------------------

Notes / assumptions

- assumes further site remediation is not required as part of Proposed Scheme;
- assumes that residual material will not be disturbed during HS2 construction works; and
- 'on-site users' excludes rail passengers (whilst within trains they will at all routine times be within a controlled environment) and maintenance workers; but includes people at stations/depots or in areas returned to public land after construction.

3.4 Assessment of temporary (construction) and permanent (post-construction) effects

Table 39: Landfill sites

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate /low	Moderate /low	Moderate/low	Neutral	Neutral
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Moderate/low	Moderate/low	Neutral	Neutral
Exposure of on-site human receptors to inhalation of gases and vapours	Moderate	Moderate	Moderate	Neutral	Neutral
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Very low	Very low	Very low	Neutral	Neutral
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Very low	Very low	Very low	Neutral	Neutral
Exposure of off-site human receptors to inhalation of ground gases	Moderate	Moderate	Moderate	Neutral	Neutral
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate	Moderate	Moderate	Neutral	Neutral
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Moderate/low	Moderate/Low	Moderate/low	Neutral	Neutral
Direct contact of property with contaminated soils and waters	Moderate/low	Moderate/low	Moderate/low	Neutral	Neutral
Exposure of property to explosive gases	Moderate	Moderate	Moderate	Neutral	Neutral
Main risk	Moderate	Moderate	Moderate		

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Overall significance				Neutral effect	Neutral effect

Table 40: 1-239 Existing West Coast Main Line (WCML) railway

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Very low	Very low	Very low	Neutral effect	Neutral effect
Main risk	Moderate/low	Moderate/low	Moderate/low		
Overall significance				Neutral effect	Neutral effect

Table 41: 1-244 Dismantled mineral railway line

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Low	Low	Low	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Low	Low	Low	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Very low	Very low	Very low	Neutral effect	Neutral effect
Main risk	Moderate/low	Moderate/low	Moderate/low		
Overall significance				Neutral effect	Neutral effect

Table 42: 1-240 Rugeley Power Station and fuel storage areas

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Main risk	Moderate	Moderate	Moderate		
Overall significance				Neutral effect	Neutral effect

Table 43: 1-246 Coal mining pit heads and spoil mounds

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Main risk	Moderate	Moderate	Moderate		
Overall significance				Neutral effect	Neutral effect

Table 44: Farm sites, all located over the MSA sensitive receptor

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Low	Low	Low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Main risk	Moderate	Moderate	Moderate		
Overall significance				Neutral effect	Neutral effect

Table 45: 1-219 Blythe Garage filling station

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Low	Low	Low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Main risk	Moderate	Moderate	Moderate/low		
Overall significance				Neutral effect	Neutral effect

Table 46: 1-136: Vehicle depot at Gorse Lane, Fradley

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Moderate/low	Moderate /low	Moderate/low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Main risk	Moderate	Moderate	Moderate		
Overall significance				Neutral effect	Neutral effect

Table 47: 1-11 and 1-157 Kings Bromley Wharf and Marine service station

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours.	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Low	Low	Low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Main risk	Moderate	Moderate	Moderate		
Overall significance				Neutral effect	Neutral effect

Table 48: 1-28 St. James' Church graveyard and cemetery

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Low	Low	Low	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Main risk	Moderate/low	Moderate/low	Moderate/low		
Overall significance				Neutral effect	Neutral effect

Table 49: 1-42, 1-263 and 1-264 Infilled former pits and quarries

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Low	Low	Low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Low	Low	Low	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Main risk	Moderate	Moderate	Moderate		
Overall significance				Neutral effect	Neutral effect

Table 50: 1-314 Business park and industrial estate

Contaminant linkage	Baseline risk	Construction risk	Post-construction risk	Construction significance	Post-construction significance
Exposure of on-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Moderate/low	Moderate/low	Moderate/ low	Neutral effect	Neutral effect
Exposure of on-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Moderate/low	Moderate/low	Moderate/ low	Neutral effect	Neutral effect
Exposure of on-site human receptors to inhalation of gases and vapours	Moderate/low	Moderate/low	Moderate/ low	Neutral effect	Neutral effect
Exposure of off-site human receptors to contamination by direct contact, ingestion and inhalation of dusts and vapours from contaminated soils	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors by direct contact, ingestion and inhalation of vapours from contaminated waters	Very low	Very low	Very low	Neutral effect	Neutral effect
Exposure of off-site human receptors to inhalation of ground gases	Moderate/low	Moderate/low	Moderate/ low	Neutral effect	Neutral effect
Exposure of groundwater to vertical and lateral migration of contaminated groundwater/leachate	Low	Low	Low	Neutral effect	Neutral effect
Discharge of contaminants to surface water by lateral migration through groundwater and direct run-off from site	Low	Low	Low	Neutral effect	Neutral effect
Direct contact of property with contaminated soils and waters	Moderate/low	Moderate/low	Moderate/low	Neutral effect	Neutral effect
Exposure of property to explosive gases	Moderate	Moderate	Moderate	Neutral effect	Neutral effect
Main risk	Moderate	Moderate	Moderate		
Overall significance				Neutral effect	Neutral effect

4 Geological sites of special scientific interest and local geological sites

- 4.1.1 No geological sites of special scientific interest (SSSI) or local geological sites are present in the Fradley to Colton area.

5 Mining and minerals data

- 5.1.1 This section presents the following data relating to mining and minerals information:
- details of planning data for minerals sites; and
 - number of marl pits in each study area.
- 5.1.2 The Staffordshire County Council New Minerals Local Plan for Staffordshire 2015-2030 adopted in 2015 shows that the route passes through a MSA for sand and gravel extraction, which is presented in Maps LQ-01-101 to LQ-01-105a.
- 5.1.3 There is a sand and gravel Area of Search between Fradley Junction and Kings Bromley that overlaps with the Proposed Scheme. There are currently no operational sand and gravel quarries in the study area. However, there is a sand and gravel quarry at Manor Park site near Kings Bromley which is no longer operational.
- 5.1.4 The area between Pipe Ridware, Blithbury and Rugeley is underlain by historical deep underground coal mines associated with the former Lea Hall Colliery at Rugeley.
- 5.1.5 There are over one hundred historical marl pits in the study area, but there is no evidence of current working of such pits, and most are very small. Many pits have filled with water and become ponds, and others have been backfilled with unspecified materials. Where the latter is the case, they have been assessed as potential contaminated sites as part of the overall baseline for the land quality study.

6 References

- Arup/ Aecom (2016), *High Speed Rail (London- West Midlands) Draft Environmental Minimum Requirements. Annex 1: Draft Code of Construction Practice*. Revised Condition A. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/577905/Code_of_Construction_Practice_-_December_2016_CLEAN_v..pdf.
- Arup et al (2013), *HS2 London – West Midlands Environmental Statement, Volume 2, Community Forum Area Report CFA22, Whittington to Handsacre*. Available online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/397889/Vol2_CF_A_22_Whittington_to_Handsacre.pdf.
- British Geological Survey (2014), *Lithostratigraphy of the Sherwood Sandstone*. Research Report RR/14/01. Available online at: <http://www.bgs.ac.uk/downloads/start.cfm?id=2904>.
- British Standard, (2013), *BS8576 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)*.
- British Geological Survey (2016), *Geology of Britain viewer*. Available online at: <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.
- British Standard (2011), *BS10175+A1:2013 Investigation of Potentially Contaminated Sites*.
- Environment Agency, *Groundwater Source Protection Zone definition*. Available online: <http://apps.environment-agency.gov.uk/wiyby/37833.aspx>.
- Environment Agency, *Pollution Incidents*. Available online: <http://maps.environment-agency.gov.uk/wiyby>.
- Environment Agency (2004), *CLR11 Model Procedures for the Management of Land Contamination*.
- Planning Portal, *Area of search*. Available online at: https://www.planningportal.co.uk/directory_record/115/area_of_search.
- Public Health England, *UK maps of radon*. Available online at: www.ukradon.org/information/ukmaps.
- Staffordshire County Council (2015), *Staffordshire County Council New Minerals Local Plan for Staffordshire 2015-2030. Final draft*. Available on line at: https://consultation.staffordshire.gov.uk/environment/staffordshire-minerals-local-plan/user_uploads/0100-the-new_---june-2015.pdf.
- Sustainable Remediation Forum UK (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation*, Contaminated Land: Applications in Real Environments (CL:AIRE), London.

High Speed Two (HS2) Limited
Two Snowhill
Snow Hill Queensway
Birmingham B4 6GA

08081 434 434
HS2Enquiries@hs2.org.uk