MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
6.25, Environmental Statement, Volume 4, Appendix Series 10 Contaminated Land
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(a)
Planning Act 2008

Author: CH2M
Date: November 2019

NetworkRail | West of England Local Enterprise Partnership | West of England Combined Authority | HM Government | Bath & North East Somerset Council | Bristol City Council | North Somerset Council | South Gloucestershire Council | travelwest

Notice

© Copyright 2019 CH2M HILL United Kingdom. The concepts and information contained in this document are the property of CH2M HILL United Kingdom, a wholly owned subsidiary of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third party.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by Jacobs for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested. Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work. This work has been undertaken in accordance with the quality management system of Jacobs.

Document history

Project	Portishead Branch Line (MetroWest Phase 1) Development Consent Order Scheme
Planning Inspectorate Scheme Reference	TR040011
Part and Application Document Reference	6, 6.25
Document title	Environmental Statement, Volume 4, Appendix 10.1 Risk Classification Appendix 10.2 Land Contamination Summary Report
Regulation Number	Regulation 5(2)(a)
Applicant	North Somerset District Council
Lead Author	RL at CH2M

Version	Date	Status of Version
Rev: 01	15/11/19	Application Issue

MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
6.25, Environmental Statement, Volume 4, Appendix 10.1 Risk Classification
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(a)
Planning Act 2008

Author: CH2M
Date: November 2019

Contents

Section Page

1 Risk Classifications.....1-1

1.1 Classification and Definition of Consequence of Risk.....1-1

1.2 Classification and Definition of Probability of Risk 1-2

1.3 Comparison of Consequence Against Probability and Related Categorisation of Risks 1-2

1.4 Description of the Classified Risks.....1-3

Tables

Table 1.1: Classification and definition of consequence of risk

Table 1.2: Classification and definition of probability of risk

Table 1.3: Comparison of consequence against probability and related categorisation of risks

Table 1.4: Description of the classified risks

Risk Classifications

1.1 Classification and Definition of Consequence of Risk

Table 1.1: Classification and definition of consequence of risk

Classification	Definition
Severe	Short term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part 2A. Short term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definitions of ecological systems within the Defra Circular on Contaminated Land, 01/2006).
Medium	Chronic damage to Human Health ("significant harm" as defined in the Defra Circular on Contaminated Land, 01/2006). Pollution of sensitive water resources. A significant change in a particular ecosystem, or organism forming part of such ecosystem. (Note: the definitions of ecological systems within the Defra Circular on Contaminated Land, 01/2006).
Mild	Pollution of non-sensitive water resources. Significant damage to buildings/structures and crops ("significant harm" as defined in the Defra Circular on Contaminated Land, 01/2006). Damage to sensitive buildings/structures or the environment.
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as Personal Protective Clothing, etc). Easily repairable effects of damage to buildings/structures.

1.2 Classification and Definition of Probability of Risk

Table 1.2: Classification and definition of probability of risk

Classification	Definition
High Likelihood	There is a pollution linkage and an event which would either appear very likely in the short term and almost inevitable over the long term, or, there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term

1.3 Comparison of Consequence Against Probability and Related Categorisation of Risks

Table 1.3: Comparison of consequence against probability and related categorisation of risks

		Consequence or Risk			
		Severe	**Medium**	**Mild**	**Minor**
Probability of Risk	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

1.4 Description of the Classified Risks

Table 1.4: Description of the classified risks

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

MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
Document No. 6.25, Environmental Statement, Volume 4, Appendix 10.2 Land Contamination Summary Report
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, regulation 5(2)(a)
Planning Act 2008

Author: CH2M
Date: November 2019

NetworkRail | West of England Local Enterprise Partnership | West of England Combined Authority | HM Government | Bath & North East Somerset Council | Bristol City Council | North Somerset Council | South Gloucestershire Council | travelwest

Table of Contents

Section Page

1 Risk Classifications 1-1
1.1 Classification and Definition of Consequence of Risk 1-1
1.2 Classification and Definition of Probability of Risk 1-2
1.3 Comparison of Consequence Against Probability and Related Categorisation of Risks 1-2
1.4 Description of the Classified Risks 1-3

1 Introduction 1-1
1.1 Description of the DCO Scheme 1-1
1.2 Purpose of Report 1-2
1.3 Sources of Information 1-3

2 Desk Study Information 2-1
2.1 Historical Land Use 2-1
2.2 Geology 2-3
2.3 Hydrogeology 2-5
2.4 Hydrology 2-6
2.5 Discharge Consents 2-8
2.6 Designated Environmentally Sensitive Areas 2-11
2.7 Coal Mining 2-11

3 Ground Investigation Information 3-1
3.1 Portishead Station and Car Park 3-1
3.2 Avon Road Bridge and Pill Station 3-13
3.3 Disused Route Section Track Ballast Testing 3-22

4 Risk Assessment 4-1
4.1 Introduction 4-1
4.2 Potential sources of contamination 4-1
4.3 Potential receptors 4-2
4.4 Potential pathways 4-2
4.5 Source-Pathway-Receptor Risk Assessment 4-2
4.6 Discussion of risk assessment 4-8
4.7 Gap Analysis 4-11

5 Conclusions and Recommendations 5-1
5.1 Conclusions 5-1
5.2 Recommendations 5-2

6 References 6-1

7 Abbreviations 7-1

Annexes

A Envirocheck Reports
B Supporting Information
C Exploratory Hole Plans
D Exploratory Hole Logs
E Laboratory Certificates
F WM3 and WAC Results
G Chemical Assessment Criteria
H Gas Monitoring Results
I Track Ballast Testing Result
J Risk Assessment Methodology

Tables

2.1 Summary of Groundwater Abstractions 2-3
2.2 Summary of Groundwater Abstractions 2-6
2.3 Summary of Surface Water Bodies 2-7
2.4 Summary of Discharge Consents 2-8
3.1 Summary of Investigation Locations - Portishead Station and Car Park . 3-1
3.2 Summary of Ground Conditions - Portishead Station and Car Park 3-2
3.3 Summary of Soil Contamination Testing - Portishead Station and Car Park 3-4
3.4 Summary of Groundwater Contamination Testing - Portishead Station and Car Park 3-6
3.5 Exceedances against GAC / CWSC Assessment Criteria - Portishead Station and Car Park 3-7
3.6 Waste Assessment Summary - Portishead Station and Car Park 3-8
3.7 Gas Monitoring Record - Portishead Station and Car Park 3-9
3.8 Initial Assessment of Gas Data - Portishead Station and Car Park 3-11
3.9 Summary of Investigation Locations - Avon Road Bridge and Pill Station 3-13
3.10 Summary of Ground Conditions - Avon Road Bridge and Pill Station ... 3-14
3.11 Summary of Soil Chemical Testing - Avon Road Bridge and Pill Station 3-14
3.12 Summary of Groundwater Chemical Testing - Avon Road Bridge and Pill Station 3-15
3.13 Exceedances against GAC / CWSC Assessment Criteria - Avon Road Bridge and Pill Station 3-16
3.14 Gas Monitoring Record - Avon Road Bridge and Pill Station 3-17
3.15 Initial Assessment of Gas Data - Avon Road Bridge and Pill Station 3-19
4.1 Source Pathway Receptor Summary 4-3

SECTION 1

Introduction

1.1 Description of the DCO Scheme

1.1.1 North Somerset District Council ("NSDC") is making an application for a development consent order ("DCO") to construct the Portishead Branch Line under the Planning Act 2008. The scheme will provide an hourly (or hourly plus) railway service between Portishead and Bristol Temple Meads, with stops at Portishead, Pill, Parson Street and Bedminster.

1.1.2 The scheme comprises the Nationally Significant Infrastructure Project ("NSIP") as defined by the Planning Act 2008 to construct the Portishead Branch Line, a new 5.5 km long railway between Portishead and the village of Pill. It is proposed to construct a new station and car park at Portishead, refurbish the station and construct a new car park at Pill, and undertake various works along the existing operational railway line between Pill and Ashton Junction where the scheme will join the existing railway. Ashton Junction is located close to the railway junction with the Bristol to Exeter Main line at Parson Street.

1.1.3 The scheme is one of several projects that form part of MetroWest, a programme of rail improvements in the West of England. Some of the other projects have to be built before the Portishead Branch Line is operational, namely improvements to Parson Street Junction (including Liberty Lane Sidings), Parson Street Station and the Bedminster Down Relief Line. These other projects will be built under Network Rail's permitted development rights and do not form part of the DCO application. However, these other projects will be considered within the Environmental Statement ("ES") as part of the cumulative effects assessment of the DCO Scheme.

1.1.4 The MetroWest Programme comprises

- MetroWest Phase 1,
- MetroWest Phase 2,
- a range of station re-opening and new station projects, and
- smaller scale enhancement projects for the West of England local rail network.

1.1.5 The MetroWest Phase 1 project comprises the delivery of infrastructure and passenger train operations to provide:

- a half hourly service for the Severn Beach line (hourly for St. Andrews Road station and Severn Beach station);
- a half hourly service for Keynsham and Oldfield Park stations on the Bath Spa to Bristol line; and
- an hourly service (or an hourly service plus) for a reopened Portishead Branch Line with stations at Portishead and Pill.

1.1.6 Figure 1.1 below shows the indicative location of the DCO Scheme at approximately 1:100,000. A more detailed plan of the DCO Scheme is provided in the General Arrangement Plans (DCO Document Reference 2.4).

1.1.7 The Order limits encompass land required temporarily and permanently for the construction and operation of the DCO Scheme. The Order limits extend from the proposed new station and car park at Portishead, along the disused section of the railway line between Portishead and Pill, and along the operational railway line between Pill and Ashton Junction, in the vicinity of Ashton Vale in south west Bristol.

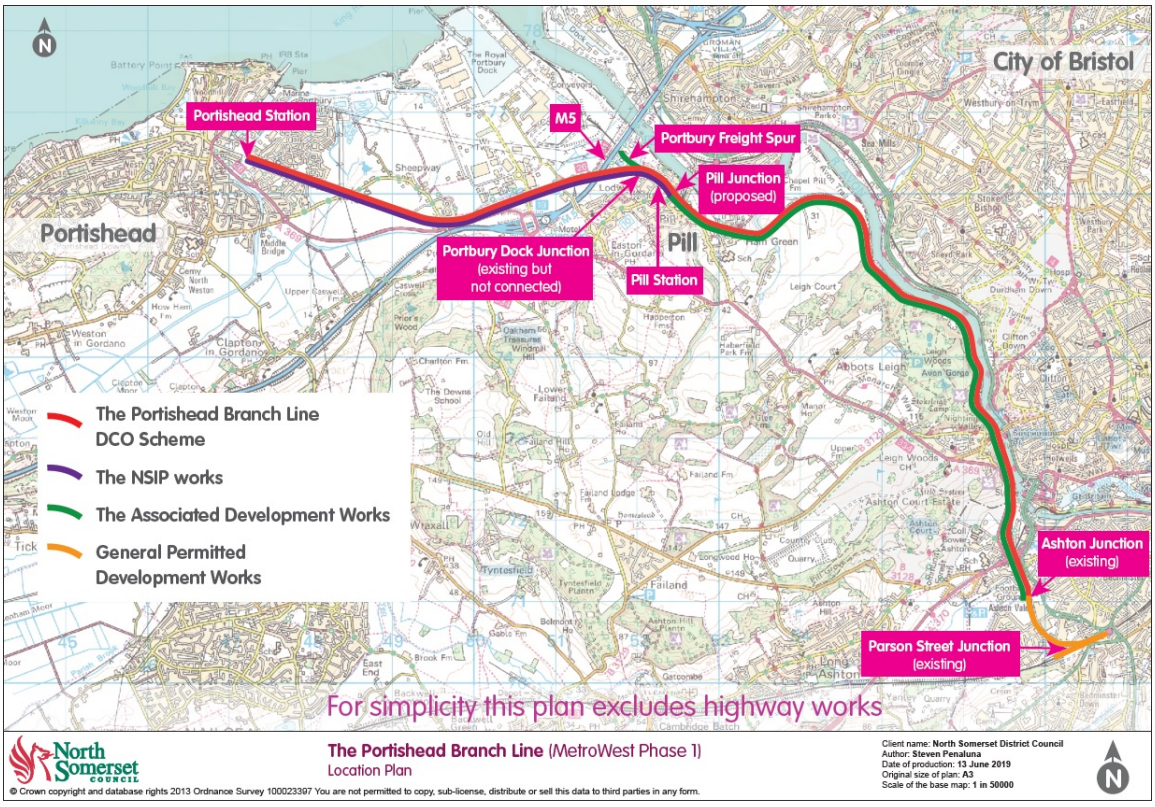

Figure 1.1: Reference Plan

1.2 Purpose of Report

1.2.1 The purpose of the report is to collate and summarise the information relating to land contamination. The project has evolved over time and several different parties have been involved in the previous investigations. Desk study and ground investigation has been undertaken for key areas of the route, but the reports are mostly factual and are split into several documents.

1.2.2 In addition, the report will present a risk assessment for the scheme, and a gap analysis to identify missing information and inform a likely timescale for obtaining this information.

1.3 Sources of Information

Desk Study

1.3.1 The following Landmark Envirocheck reports enclosed in Annexes A1 to A4 have been obtained for Portishead Station, the disused railway section of the works including Portbury and Easton-in-Gordano and Pill Station (hereafter referred to as "Disused Route Section"):

- Portishead Station – Envirocheck Report reference 54372246_1_1, March 2014 (Annex A1);
- Portishead to Portbury – Envirocheck Report reference 107496446_1_1, December 2016 (Annex A2);
- Portbury to Easton-in-Gordano – Envirocheck Report reference 10496446_1_1, December 2016 (Annex 3); and
- Pill – Envirocheck Report reference 107496446_1_1, December 2016 (Annex A4).

1.3.2 A Preliminary Sources Study Report including an Envirocheck report has been consulted for a proposed new pedestrian and cycle ramp between Ashton Vale Road and Ashton Road which is part of the associated works. The relevant part of the Envirocheck report is enclosed in Annex A5 and the desk study report is enclosed in Annex B1:

- Ashton Vale Road Alternative Highway Access Preliminary Sources Study Report, CH2M July 2017 (includes Coal Mining Risk Assessments from the AVTM Scheme).

1.3.3 Note: Network Rail has Envirocheck data for the existing rail sections (Pill Station to Parson Street Junction) – not shared.

1.3.4 Other sources of information include:

- Google mapping and Google Earth Aerial photos;
- The Environment Agency's Catchment Data Explorer;
- The Environment Agency's What's in Your Backyard datasets (publicly available datasets downloaded into a proprietary GIS) – includes historical and authorised landfills, groundwater source protection zones, pollution incidents and geological mapping); and
- Defra MAGIC Maps.

Ground Investigation

1.3.5 The following reports have been consulted to inform the ground conditions for the DCO Scheme:

- Ashton Vale Road Alternative Highway Access Preliminary Sources Study Report, CH2M July 2017 (includes Ground Investigation from the MetroBus m2 scheme from Ashton Vale Park and Ride to Bristol city centre) (enclosed in Annex B1); and
- Factual Geotechnical Report, Portishead Car Park, ACS, report number 16-78919/AD/FGReport, January 2017 (includes chemical analysis for land quality) (enclosed in Annex B2);
- Factual Report on Ground Investigation at MetroWest, report no. 730673, January 2016 (Structural Soils/Arup, 2016). – not appended, part of NRIL GRIP 3 reports.

Interpretative Reports

1.3.6 The following reports have been consulted to inform the ground conditions for the DCO Scheme:

- Trackbed Investigation, MetroWest Phase 1 Interpretative Report, report no. 4707004/WT/PL/140569/2, April 2014 (URS, 2014);
- Metrowest Phase 1, Trackbed Report, report no. W1097B-ARP-REP-ETR-000008, April 2016 (Arup, 2016); and
- Track Ballast Re-Use Outline Risk Assessment, Technical Memorandum, June 2016 – in draft, not issued (CH2M, 2016).

SECTION 2

Desk Study Information

2.1 Historical Land Use

2.1.1 A review of historical mapping from the Envirocheck reports and environmental regulator information obtained for the Disused Route Section provided in the following sections. The study area has been based on a 500 m boundary from the railway for considering potentially contaminative sites and potential receptors which are shown on Figure 10.1 from the ES (see drawing no. 674946 -001-015-A). Groundwater abstractions and source protection zones are considered within 2 km of the DCO Scheme.

Portishead

2.1.2 Portishead Station was opened in 1867 and demolished in 1954 to make way for the Portishead B Power Station. A new railway station was built in 1954, where the Waitrose petrol station now stands, but subsequently closed in 1964 and was demolished. The proposed location of the Portishead station is to the east of the Waitrose site and requires a realignment of Quays Avenue with a new roundabout where it connects at Harbour Road. A power station ash landfill is located to the north of the railway, east of Haven View.

2.1.3 The 1884 edition of the OS map shows the railway to the port at Portishead already present and the land between this and the town centre largely undeveloped and low lying. An inlet of the estuary approaches to the north. There is a gas works noted to the north and a nail works to the south as well as the various dock-related activities to the north. Between 1931 and 1968 the area was substantially modified with infilling of the inlet and establishment of the road network including Harbour Road to the north. The new development area was used for railway sidings with cranes. A fuel depot, located to the south of the railway and location of Portishead Station is established by 1970. By 1974, some of the current commercial buildings along Old Mill Road were established. By 1987, the sidings were gone and the rail connections to the docks were much reduced with further commercial development along Old Mill Road and Harbour Road. Between 1987 and 1999 the last rail connections to the docks were removed and much of the industrial activity in the area ceased. Redevelopment of the area was well established by 2003 and development continued through to 2005 when the current Waitrose building and car park were completed.

2.1.4 The area to the west of Quays Avenue bounded by Wyndham Way to the south, the railway to the north, and a drainage ditch to the west, was marked as a "depot" between 1970 and 1999 on the OS mapping. This is the site of a fuel storage depot, which has since been cleared and remediated to make way for redevelopment.

2.1.5 To the east of Quays Avenue, the 1884 OS edition shows the railway as established with the surrounding area divided by field boundaries, which remained unchanged until 1961. The 1968 OS edition shows land raising in cells either side of the drainage ditch, one of which is labelled as a refuse tip. The 1974 OS edition labels these as slag heaps with the 1987 OS

edition showing "Tips Disused". Aerial imagery from 2003 shows the current road network being constructed with its completion by 2005 and construction of the residential housing to the north underway.

2.1.6 Communications with North Somerset District Council indicate that there is a disused Ministry of Defence oil pipeline under the proposed site for planned car park B. No details are available with regard to closure or purging of the pipeline. A Wessex Water sewer passes under the proposed site of Portishead station.

Disused Route Section

2.1.7 The railway corridor was established along its present route in the 1860s, prior to the first edition of the OS map in 1884. The historic maps show that no changes to the railway route have occurred since that time. However, the railway services were stopped, with the line closed to passenger services in 1964 and for freight in 1981. The Portbury Freight Line was re-opened in 2002 to Portbury Dock for freight only.

2.1.8 The Priory Farm Landfill, is located to the south of the railway, bounded to the west by Sheepway Road and to the south by the A369. The Envirocheck report indicates that it may have received inert and non-hazardous wastes (although these may not be consistent with the modern definitions of wastes). The Environment Agency website indicates that the Priory Farm Landfill had leachate and gas controls.

2.1.9 Another landfill, Elm Tree Farm, is located in Sheepway approximately 250 m to the north of the disused railway. Housing is present between the landfill and the railway.

Pill Station

2.1.10 Pill Station was opened in 1867 and closed in 1964. The 1881 OS map shows the railway line in place and a station located within the village. By 1915, Monmouth Road has been built to the north of the railway with housing. Further residential development occurred between 1938 and 1955 continuing until the village reached its current extent sometime between 1970 and 1981. The original station is no longer in use, following closure of the railway in 1964.

2.1.11 The proposed car park to the west of the station is located on former railway sidings / goods yard. These appear on the 1915 OS edition consisting of a single track off the main line with a number of buildings.

Ashton Vale Road

2.1.12 Between 1850 and 1949, there was open cast coal mining around the proposed site of the pedestrian and cycle ramp at Ashton Vale Road (see the ES Volume 3 Book of Figures, Figure 10.1, DCO Document Reference 6.24, and the General Arrangement Plan, DCO Document Reference 2.4), The 1894 OS map shows there was a colliery, shaft, an iron works and a tank between 50 m and 150 m from the site. There was also disused colliery approximately 150 m south of the site (Frayne’s Colliery) and an old coal pit approximately 500 m south of the site in Aston Vale. The Bristol and Portishead Railway is shown running through Ashton Vale. From the 1887 and 1904 – 1905 OS maps, there was a smithy 100 m northeast of the site

on Ashton Road, a nail works 100 m southeast of the site and rolling mills 200 m southeast of the site in the area of Ashton Gate. The 1930 OS map shows tanks within 50 m of the site, a brick and tile works in the area of Ashton Vale Road at 250 m west of the site and saw mills with timber yards 100 m to the south in the area of the present day Cala Trading Estate. Warehouses and stores developed in this area from the 1950s to present. The Envirocheck report indicates infilled land in the area of the open cast coal mining which extends from the site and westwards for up to 280 m. The site today is surrounded by commercial and industrial properties of the Cala Trading Estate.

2.1.13 There are three historical landfills between 10 m and 450 m of the site. There is no information available about the Cala Trading Estate landfill located closest to the site on Ashton Vale Road regarding input dates and waste types accepted. ‘Phase 2 landfill Site at Parsonage Farm’ and ‘Phase 3 landfill site at Ashton Vale’ at 450 m west of the site received inert, industrial and commercial waste types between the early 1980s and 1991.

2.2 Geology

2.2.1 The geological sequence underlying the DCO Scheme is described in Table 2.1.

Table 2.1: Summary of Groundwater Abstractions

Period	Strata	Description
Triassic	Mercia Mudstone Group	Dominantly red, less commonly green-grey, mudstones and subordinate siltstones. Thin beds of gypsum/anhydrite widespread; sandstones are also present.
Carboniferous	Pennant Sandstone Formation	Green-grey and blue-grey sandstones with thin mudstone/ siltstone and seatearth interbeds and mainly thin coals.
	South Wales Middle Coal Measures Formation	Grey coal-bearing mudstones/siltstones, with seatearths and minor sandstones.
	Cromhall Sandstone Formation	Brown and red fine- to coarse-grained quartzitic sandstone with subordinate mudstone and limestone.
	Oxwich Head Limestone Formation	Thick bedded fine- to coarse-grained, limestones. Units of dark grey, irregularly bedded skeletal packstones with shaly partings are developed at intervals.
	Clifton Down Limestone Formation	Mudstones and limestones. Sandy limestone at base in Bristol area.

Table 2.1: Summary of Groundwater Abstractions

Period	Strata	Description
	Goblin Combe Oolite Formation	Massive, medium to coarse grained oolitic limestone with lenses of crinoidal limestone.
	Clifton Down Mudstone Formation	Thin- to medium-bedded calcite and dolomite mudstones. A unit of crinoidal and oolitic limestones occurs in the middle of the Formation, and a 15 m-thick unit of oolitic and crinoidal limestone occurs in the upper part of Formation.
	Gully Oolite Formation	Medium- to thick-bedded oolitic grainstone with fine-grained skeletal packstones. Locally in the north Bristol to Tytherington area 6-21 m of grey crinoidal limestones, the Sub-Oolite Bed, occurs at the base of the Formation.
	Black Rock Limestone Subgroup	Thin to thick-bedded fine to coarse grained packstones with subordinate thin beds of argillaceous packstone and mudstone.
	Avon Group Mudstone and Limestone	Interbedded grey mudstones and thin- to medium-bedded skeletal packstones with one to several thick units of ooidal and skeletal grainstones. Thin units of calcite mudstone and mudstone locally present. Sparse thin ironstones.
	Avon Group Limestone	Interbedded grey mudstones and thin- to medium-bedded skeletal packstones with one to several thick units of ooidal and skeletal grainstones. Thin units of calcite mudstone and mudstone locally present. Sparse thin ironstones.
	Shirehampton Formation	Interbedded, thin- to medium-bedded red, green and grey mudstone, limestone, sandstone and siltstone with a thick red crinoidal limestone.
Devonian	Portishead Formation	Red-green mudstones and marls, red siltstones and red-yellow, hard, fine-grained quartzose sandstones, with conglomerate locally.
	Black Nore Sandstone Formation	Sandstones

2.2.2 The Portishead to Pill section of the Portishead Branch Line lies on sediments of the Mercia Mudstone Group for the most part overlain by Tidal Flat Deposits. The Mercia Mudstone Group comprises dominantly red, less commonly green-grey, mudstones and subordinate siltstones with thin beds of gypsum/anhydrite and sandstones also present. Tidal Flat Deposits comprise clay with sand, gravel and peat. There are deposits of artificial ground along the section of the route within Portishead.

2.2.3 The Portbury Freight Line crosses River Terrace Deposits comprising sands and gravels and Head deposits comprising clay, silt, sand and gravel around Pill and crosses an area of alluvial clays and silts associated with a small stream tributary of the River Avon north of Ashton Gate.

2.2.4 The Portbury Freight Line crosses coal-bearing strata the surface along the southernmost section around Ashton Gate (which lies within the Red Line Boundary for the DCO Scheme). An old coal pit is marked on the 1884 OS map, some 300 m to the west from the railway which survives on mapping editions up to 1955 when the area is developed as allotments. At Ashton Gate the earliest OS map dated 1886 shows Fraynes Colliery as being disused and a colliery associated with the Ashton Vale Ironworks to the north which remains until sometime in the 1940s. Given the long-established nature of the railway no impacts are considered from mining.

2.3 Hydrogeology

Aquifer Designations

2.3.1 The Carboniferous sediments are classified as a Principal aquifer; these are layers of rock having high permeability and can provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. The groundwater vulnerability (the ability of an aquifer to transmit pollution to groundwater) in the aquifer is high to intermediate.

2.3.2 The Devonian sandstones are classified as Secondary A aquifers; permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. The groundwater vulnerability in the aquifer is high to intermediate.

2.3.3 The Mercia Mudstone is classified as a Secondary B aquifer; predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers. The groundwater vulnerability in the aquifer is intermediate to low.

2.3.4 The River Terrace Deposits are classified as Secondary A aquifers and are likely to provide limited water resources due to their limited catchment, being isolated over less permeable lithologies.

Groundwater Abstractions and Source Protection Zones

2.3.5 There are seven groundwater abstraction points between 365 m and 1823 m from the DCO Scheme, as summarised in Table 2.2. There are no source protection zones along or within 2 km of the DCO Scheme.

Table 2.2: Summary of Groundwater Abstractions

Location (NGR)	Distance from DCO Scheme (m)	Operator(s)	Abstraction Information
Borehole, Easton-In-Gordano (350830, 175600)	365	Welcome Break on Junction 19	For general use in industrial, commercial or public services (medium loss). Permit end date is not supplied
Lafarge Borehole B (350630, 176800)	772	Siniat Limited and Lafarge Plasterboard Ltd	For general use in industrial, commercial or public services (medium loss). Permit end date is not supplied
Lafarge Borehole A (350590, 176830)	814	Siniat Limited and Lafarge Plasterboard Ltd	For general use in industrial, commercial or public services (medium loss). Permit end date is not supplied
Pen Pole - Borehole 3, Shirehampton (352950, 177600)	1565	Rhodia Uk Limited	For use in chemicals as process water and for non-evaporative cooling purposes. Permit end date is not supplied.
Pen Pole - Borehole 1, Shirehampton (353040, 177610)	1617	Rhodia Uk Limited and Rhodia Organique Fine Limited	For use in chemicals as process water and for non-evaporative cooling purposes. Permit end date is not supplied.
Pen Pole - Borehole 2, Shirehampton 353150, 177600)	1664	Rhodia Uk Limited	For use in chemicals as process water and for non-evaporative cooling purposes. Permit end date is not supplied.
Portishead (346200, 175700)	1823	H D Stuckey	For use in general farming and domestic purposes. Permit end date is not supplied.

2.4 Hydrology

Surface Water Bodies

2.4.1 There are several culverted watercourses and unnamed water bodies (small ponds and streams) within 500 m of the DCO Scheme. For the purposes of this summary report, only the main surface water features which are anticipated to be of relatively high importance have been considered and are summarised in Table 2.3. There are no surface water abstractions within 500 m of the DCO Scheme.

Table 2.3: Summary of Surface Water Bodies

Surface Water Body	Distance from DCO Scheme (m)	Description and Status
Portbury Ditch	0	Located southwest of Portbury Wharf and flows north eastwards in a straight channel into the Severn Trent Estuary. Designated as a heavily modified main river and classified under the Water Framework Directive (WFD) (Cycle 2, 2016) as having a 'good' chemical status.
Chapel Pill (Ham Green Lake)	0	Located east of Chapel Pill Lane and flows beneath the railway from Ham Green to Chapel Pill Farm. WFD chemical status not classified.
Eastern-in-Gordano	0 (culverted)	Located northeast of Junction 19 and flows northwards beneath the railway from south of Easton-in-Gordano village and discharges into to the River Avon. WFD chemical status not classified.
Markham Brook	0 (culverted)	Located within local wildlife site in Pill beneath the railway viaduct. WFD chemical status not classified.
Longmoor Brook	0 (culverted)	Located south of Ashton Value Road. Flows west to east from Long Ashton, and discharges into the River Avon and Colliter's Brook. Designated as Main River. WFD chemical status not classified.
Colliter's Brook	0 (culverted)	Located north of Barons Close in Ashton Junction. Flows in a north easterly direction towards Ashton Gate and discharges into the River Avon. Designated as a main river. WFD chemical status not classified.
River Avon	20	Located to the north and immediately east of the railway line. Tidally influenced main river classified under the WFD as having a 'good' chemical status.
Drove Rhyne	100	Located north of Junction 19 in Portbury and flows northwards A main river which outfalls to the Bristol Channel. Highly modified and straightened channel with controlled water levels. WFD chemical status not classified.
The Moat	170	Located within Portbury Wharf Nature Reserve and flows northwards into the Bristol Channel with tidal wall bounding its west side. WFD chemical status not classified.

Flood Risk

2.4.2 Between Portishead and Pill, the DCO Scheme is on low-lying coastal terrain intersected by drains and streams linked to the River Avon and Bristol Channel. This terrain is at risk from tidal flooding and much of it is designated as Flood Zone 2 (medium probability of flooding) or Flood Zone 3 (high probability of flooding). However, the land benefits from existing natural and man-made flood defences. There is also a potential for groundwater flooding to occur at the surface in the areas of Portishead, Sheepway and Portbury along the DCO Scheme.

2.5 Discharge Consents

2.5.1 The discharge consent records in the Envirocheck Reports have been reviewed as discharges may have the potential to adversely affect groundwater. There are 26 active discharge consents within 500 m of the DCO Scheme, summarised in Table 2.4, comprising water company sewage discharges (storm water overflow) and trade effluent discharges from domestic and commercial properties.

Table 2.4: Summary of Discharge Consents

Location(s) (NGR)	Distance from DCO Scheme (m)	Operator(s) (no. of active consents)	Consent Information*
Harbour Road CSO, Bristol (347200, 176480)	0	Wessex Water Services Ltd (1)	New Consent for sewage discharges into Portbury Ditch.
Portishead Town Pumping Station (347200, 176480; 347620, 176400)	0 – 61	Wessex Water Services Ltd (1)	Modified Consent (Water Resources Act 1991, Schedule 10 as amended by Environment Act 1995) for sewage discharges into Portbury Ditch.
Plot 18, Car Storage, Royal Portbury Docks, Bristol	44	The Bristol Port Company (2)	New Consents for trade effluent discharge (site drainage) into Drove Rhyne.
Ashton Avenue Pumping Station, Bristol (356890, 172030)	25	Wessex Water Services Ltd (1)	New Consent for public sewage discharges (storm sewage overflow) into the River Avon.
Nail Factory Offices, Old Mill Road, Portishead (347100, 176350)	133	Mustad Manufacturing Co (1)	Consent (Transferred from Rivers (Prevention of Pollution) Act 1951-1961) for sewage discharges (final/treated effluent) into Portbury Brook.

Table 2.4: Summary of Discharge Consents

Location(s) (NGR)	Distance from DCO Scheme (m)	Operator(s) (no. of active consents)	Consent Information*
Plots 29, 30, 31 Drove Road Royal Portbury Dock, Avonmouth, Bristol (350001, 175901; 349900, 176150)	136 – 399	Toyota (Gb) Ltd (2)	New Consents, by Application for trade effluent discharge (site drainage) into the Drove Rhyne
Pill Pumping Station, Avon Road, Pill (352280, 176410)	199	Wessex Water Services Ltd (1)	New Consent, by Application for sewage discharges into the Bristol Avon Estuary.
Harbour Road (Temp) Doctors Surgery, Portishead	208	Pearce Developments Ltd – single domestic property (1)	New Consent for sewage discharges (final/treated effluent) into Portishead Dock.
Plot 23, Royal Portbury Dock, Portbury, Bristol (351560, 176510)	240	The Bristol Port Company (1)	New Consent for trade effluent discharge (site drainage) into Portbury Ditch.
Lane Group Plc Regional Freight Centre, Portbury, Bristol (350740, 176300)	265	Wincanton Group Ltd (1)	New Consent, by Application for trade effluent discharge (site drainage) into the River Avon.
Station Road CSO Outside Lamplighters Pub, Shirehampton (352680, 176210)	305	Wessex Water Services Ltd (1)	New Consent for public sewage discharges (storm sewer overflow) into River Avon.
Outside 7 Springfield Avenue CSO (352630, 176270) and 30 Station Road (352630, 176270), Bristol.	306	Wessex Water Services Ltd (3)	New Consents for public sewage discharges (storm sewage overflow) into the River Avon.
Lamplighters Sewage Pumping Station, Shirehampton, Bristol (352630, 176270)	306	Wessex Water Services Ltd (1)	New Consent for sewage discharges into a tributary of the River Avon.

Table 2.4: Summary of Discharge Consents

Location(s) (NGR)	Distance from DCO Scheme (m)	Operator(s) (no. of active consents)	Consent Information*
Portbury Drove Pumping Station, Portbury, Bristol (349940, 176070)	313	Wessex Water Services Ltd (1)	Consent (varied under Environmental Permitting Regulations 2010) for sewage discharges into Portbury Drove Rhyne.
Dock Cottages, Hotwells next to Cumberland Basin, Bridge, Hotwells, Bristol (357140, 172240)	323	Wessex Water Services Ltd (1)	Deemed Consent: Transitional Provisions (Section 40) for sewage discharges (final/treated effluent) into a tributary of the River Avon.
New Dwelling, Sheepway, Portbury, Bristol, Avon (349140, 176160)	338	Mr D M Axford – single domestic property including farm house (1)	New Consent, by application for sewage discharges (final/treated effluent) as soakaway.
Royal Portbury Dock, Easton In Gordano, Bristol (351061, 176501; 350909, 176526)	343 – 419	First Corporate Shipping (2)	New Consent for trade discharges (site drainage) into Unnamed Rhyne.
Outside 57 Ashton Drive (356900, 170690); and Hendre Road, outside Corner of No. 47, Bristol (357240, 170990)	363 – 440	Wessex Water Services Ltd (2)	Consent (varied under Environmental Permitting Regulations 2010) for public sewage discharges (storm sewage overflow) into the River Malago.
Plot 23, Royal Portbury Dock, Portbury, Bristol (351340, 176590; 351600, 176730)	366 – 446	The Bristol Port Company (2)	New Consents for trade discharges (site drainage) into tributary the Drove Rhyne.

* New consents were issued under the Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995.

2.6 Designated Environmentally Sensitive Areas

2.6.1 The Portbury Freight Line passes through Avon Gorge and Ham Green which are Sites of Special Scientific Interest ("SSSI"). Ham Green SSSI is also of geological importance as it hosts a complete local succession of the Carboniferous Limestone.

2.6.2 North Somerset District Council has designated an area centred on the Ashton Estate as a Regionally Important Geological and Geomorphological Sites ("RIGS") which extends eastwards as far as the Rownham Plantation. Bristol City Council has designated part of the Avon Gorge as a RIGS. However, the DCO Scheme does not cross either designation.

2.7 Coal Mining

2.7.1 The proposed works at Ashton Gate Level Crossing and Barons Close Pedestrian Crossing (Part 2 DCO General Arrangement Plan Sheet X) are located within the defined coalfield and accordingly due consideration should be afforded to ground conditions and the potential for unstable land to be present. The Coal Authority has records of recorded mine entries in the vicinity and likely presence of historic unrecorded underground coal mining at shallow depth.

2.7.2 The DCO Scheme will not require the closure of the Ashton Gate Level Crossing. The design consists of extension of the left turn flare lane on Winterstoke Road, optimisation of the Ashton Vale Road signals, and upgrade of signals to 'MOVA', and provision of a ramp to the north of the level crossing to connect pedestrians and cyclists from Ashton Vale Road to Ashton Road. With these modifications, the DCO Scheme is unlikely to need further assessment for coal mining risk.

SECTION 3

Ground Investigation Information

3.1 Portishead Station and Car Park

3.1.1 A site visit was carried out in March 2014 at the proposed new Portishead Station site. The proposed station site within the railway boundary was observed to be largely overgrown with trees and bushes. The proposed car park area comprises a raised area of grassland along Quays Avenue and Harbour Road. There was no visual evidence of any contamination present. Evidence of a ground investigation was seen within the proposed car park area with three gas monitoring standpipes and disturbed ground at a number of locations resulting from trial pitting was observed. The Made Ground at the exposed surface of the trial pits comprised a clay and sand matrix with gravel and cobbles of bricks, sandstone and slag; visual evidence of contamination was observed.

3.1.2 An intrusive investigation was undertaken in September 2015 by Structural Soils Limited (2016) on behalf of Arup to determine the ground conditions on the site of the proposed new Portishead Station. A subsequent intrusive investigation was undertaken by ACS Group in December 2016 at the site of the proposed car park (ACS 2017).

3.1.3 The following sections report the findings of the contamination testing and environmental monitoring undertaken at the investigation locations shown on the exploratory hole plan in Annex C1 and listed in Table 3.1 below. The factual report for the intrusive investigation undertaken in November 2015 is enclosed in Annex B1.

Table 3.1: Summary of Investigation Locations - Portishead Station and Car Park

Exploratory Hole	Easting	Northing	Location	Bottom Depth (mbgl)	Groundwater encountered during investigation (mbgl)
TPPH03	347299.00	176431.00	Car Park	3.50	Not Encountered.
TPPH04	347367.00	176410.00	Car Park	3.00	Water seepage from base up to 2.90 mbgl.
TPPH05	347443.00	176407.00	Car Park	3.50	Small amount of water seepage at 2.70 mbgl.
TPPH06	347515.00	176397.00	Car Park	2.10	Not Encountered.
CPT1	347488.30	176362.20	Portishead Station Site	1.30	Not Encountered.

Table 3.1: Summary of Investigation Locations - Portishead Station and Car Park

Exploratory Hole	Easting	Northing	Location	Bottom Depth (mbgl)	Groundwater encountered during investigation (mbgl)
CPT3	347633.50	176310.70	Portishead Station Site	1.20	Not Encountered.
CPT4	347666.50	176298.90	Portishead Station Site	1.20	Not Encountered.
CPT6	347742.40	176271.90	Portishead Station Site	1.20	Not Encountered.
BH1 (19mm)	347545.70	176344.40	Portishead Station Site	5.00	N/A
BH1 (50mm)	347545.70	176344.40	Portishead Station Site	21.90 (18.00)*	First encountered at 3.00 mbgl.
BH2 (50mm)	347705.70	176285.70	Portishead Station Site	29.70 (19.80)*	First encountered at 2.00 mbgl.

* Borehole standpipe depth is indicated in parentheses.

Ground Conditions

3.1.4 Exploratory hole logs for the investigation locations can be viewed in Annex D1 and a summary of the ground conditions is provided in Table 3.2.

Table 3.2: Summary of Ground Conditions - Portishead Station and Car Park

Stratum	Overall Description	Encountered Depths (mbgl)			
		Top		Base	
		From	To	From	To
Topsoil	Soft brown clayey sandy gravelly silt. Gravel is fine, medium and coarse; angular to sub-rounded of stone.	0	0	0.35	0.68

Table 3.2: Summary of Ground Conditions - Portishead Station and Car Park

Stratum	Overall Description	Encountered Depths (mbgl)			
		Top		Base	
		From	To	From	To
Made ground	Dark grey to brown gravelly sand and clay, sandy gravel and clayey sandy silt. Gravel consists of flint, clinker, stone, brick, ballast, slag, limestone, macadam, glass, granite and wood. High organic content and rootlets noted at the site of proposed new Portishead Station.	0	0.35	1.00	1.30
Tidal flat deposits	Greyish to bluish sandy silt to silty clay with rootlets and occasional pseudo-fibrous peat horizons.	0.68	1.30	17.25	18.15
Mercia Mudstone Group	Reddish brown sandy clay and thinly bedded brown mudstone with gravel sized lithorelicts.	17.25	18.15	>21.90	>29.70

Chemical Testing

3.1.5 11 samples from 10 exploratory holes were scheduled for chemical testing at MCERTS and UKAS accredited laboratories to assess if contamination is present within the soils. Leachability testing was undertaken on selected samples to determine if leachable contaminants are present in the soils which could adversely affect sensitive water receptors. Testing was carried out in accordance with the testing suites specified in the UK Specification for Ground Investigation ("UKSGI") (ICE Publishing, 2012), and with MCERTS/UKAS standards where noted on the laboratory certificates enclosed in Annex E.

3.1.6 Additionally, Waste Acceptance Criteria ("WAC") testing was undertaken on selected samples from the November 2015 ground investigation to refine the potential waste classification if soil arisings / wastes are to be disposed of to landfill. Testing was carried out using the WAC testing suite modified from the UKSGI (ICE Publishing, 2012). The WAC results can be used to assess whether waste soil can be disposed to hazardous, non-hazardous, inert or stable non-reactive hazardous waste landfills or cells once the WM3 assessment has assessed whether the material is hazardous or not. A Waste Soils Characterisation Assessment Tool 'CatWaste' was used to classify all trial pit samples as either hazardous or non-hazardous waste in accordance with Environment Agency (2015) WM3 Technical Guidance. The WM3 and WAC testing results are presented in the factual report in Annex F.

3.1.7 A summary of soil contamination testing is given in Table 3.3.

Table 3.3: Summary of Soil Contamination Testing - Portishead Station and Car Park

Exploratory Hole	Sample Depth (mbgl)	Strata (see notes)	Description of Strata	Testing (see notes)		
				S	L	WAC
TPPH03	0.30	MG	Dark grey gravelly sand. Gravel is fine, medium and coarse; angular to sub-rounded of clinker, brick, macadam, glass and stone.	✓	✓	✓
TPPH04	0.40	MG	Dark grey very gravelly sand. Gravel is fine, medium and coarse; angular to sub-rounded of clinker, stone and brick.	✓	✓	
TPPH04	1.10	MG	Dark grey very gravelly sand. Gravel is fine, medium and coarse; angular to sub-rounded of clinker, stone and brick. Wood recorded below 0.60 m.	✓	-	-
TPPH05	0.30	TS	Soft greyish brown sandy gravelly silt. Gravel is fine, medium and coarse; subangular to rounded of stone.	✓	-	-
TPPH06	0.90	MG	Grey mottled brown clayey sandy silt. Rare brick noted. Black gravel noted in the northern end of the pit at 1.20 m, possible unknown service.	✓	✓	✓
CPT1	0.60	MG	Dark greyish black clayey sandy gravel with a low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse limestone, granite and ballast. Cobbles are angular ballast, limestone and granite up to 20 mm.	✓	✓	-

Table 3.3: Summary of Soil Contamination Testing - Portishead Station and Car Park

Exploratory Hole	Sample Depth (mbgl)	Strata (see notes)	Description of Strata	Testing (see notes)		
				S	L	WAC
CPT3	0.20	MG	Dark grey to black clayey sandy gravel with frequent rootlets and a low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse ballast, limestone, clinker and slag. Cobbles are angular limestone, ballast, slag and clinker up to 150 mm.	✓	✓	-
CPT4	0.50	MG	Dark grey slightly clayey sandy gravel with a low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse ballast and limestone. Cobbles are angular spherical to tabular ballast up to 150 mm.	✓	✓	-
CPT6	0.30	MG	Dark grey clayey sandy gravel with occasional rootlets and cobbles. Sand is fine to coarse. Gravel is angular to subangular fine to coarse ballast. Cobbles are tabular angular ballast up to 140 mm.	✓	✓	-
BH1	0.50	MG	Dark grey to black clayey sandy gravel with a low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse ballast, slag, clinker and limestone.	✓	✓	-
BH2	1.00	MG	Brown slightly sandy gravelly clay with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse limestone.	✓	✓	-

Notes:
MG = Made Ground, TS = Topsoil, S = Soil (includes asbestos screening),
L = Leachate, WAC = Waste Acceptance Criteria.

3.1.8 Additionally, groundwater samples collected from BH1 and BH2 during the gas and groundwater monitoring programme undertaken between November 2015 and January 2016 were scheduled for chemical testing. Testing of groundwater samples was broadly carried out in accordance with groundwater testing suite listed in the UKSGI (ICE Publishing, 2012), and with MCERTS/UKAS standards where noted on the laboratory certificates enclosed in Annex E. The summary of groundwater chemical testing is presented in Table 3.4.

Table 3.4: Summary of Groundwater Contamination Testing - Portishead Station and Car Park

Exploratory Hole	Sample Top Depth (mbgl)	Response Zone Depth (mbgl)	Response Zone Strata
BH1 (19 mm)	3.00	1.00 – 5.00	Made ground and tidal flat deposits
BH1 (50 mm)	12.00	6.00 – 18.00	Tidal flat deposits
BH2 (50 mm)	13.00	0.80 – 20.00	Made ground, tidal flat deposits and Mercia Mudstone Group.

Contamination Assessment

3.1.9 Based on the proposed development, comprising the new Portishead Station and a car park, soil analytical data has been screened against published Generic Assessment Criteria ("GAC") for a Public Open Space (residential) scenario which is suitable for a development in close vicinity to residential properties. GAC are pre-defined concentrations for individual contaminants, below which an actual or potentially unacceptable risk is not considered to be present where a pollutant linkage exists. Where contaminants are found to exceed the GAC, they are identified as contaminants of concern and an assessment is then required regarding the viability of the potential pollutant linkages.

3.1.10 The soil data has initially been compared against C4SLs (Category 4 Screening Levels), which were published by CL:AIRE in partnership with the Department for Environment, Food and Rural Affairs (DEFRA 2014). They are offered as support to the Statutory Guidance for Part 2A of the Environmental Protection Act 1990 (DEFRA, 2012). They are intended to be used to screen out sites that are within the definition of Part 2A's Category 4 Human Health, i.e. where the concentrations in soil "*pose an acceptable level of risk*" and the site is "*definitely not contaminated land*" under planning legislation.

3.1.11 To date, however, C4SLs have only been published for six key indicators of contaminated land. Where C4SLs are not available, S4ULs (Suitable for Use Levels) published by CIEH/LQM (Nathanail et al., 2015) have been used. These have been published for a variety of land uses and soil organic matter ("SOM") levels. A 1% SOM has been adopted for the assessment, since this represents the most conservative approach. The Environment Agency ("EA") Soil Guideline Value ("SGV") of 0.008 mg/kg (Environment Agency, 2009) for residential property has been used for assessing PCBs.

3.1.12 Where volatile organic compounds ("VOC") are detected, the values have been screened against GAC published by EIC/AGS/CL:AIRE (2010) for a scenario of residential (with plant uptake), if available, as GAC for POS are not available.

3.1.13 Leachate and groundwater results have been screened against Controlled Waters Screening Criteria ("CWSC"); firstly against Freshwater Environmental Quality Standards ("EQS") from the Water Framework Directive (2015), and where EQS are not available, Drinking Water Standards ("DWS") based on the Water Supply (Water Quality) Regulations 2016 have been used.

3.1.14 All assessment criteria used for the assessment of soils, leachate and groundwater results are listed in Annex G. Exceedances against assessment criteria are listed in Table 3.5. Asbestos was not detected in any samples. However, it is possible that asbestos may be present elsewhere on the site.

Table 3.5: Exceedances against GAC / CWSC Assessment Criteria - Portishead Station and Car Park

Exploratory Hole	Sample Depth (mbgl)	Sample Type	Exceedances against GAC / CWSC
TPPH03	0.30	Soil	EQS: copper (0.008 mg/l); mercury (0.0002 mg/l); lead (0.005 mg/l).
TPPH04	0.40	Soil	EQS: copper (0.017 mg/l); nickel (0.006 mg/l); zinc (0.033 mg/l).
TPPH04	1.10	Soil	C4SL: lead (1970 mg/kg).
TPPH06	0.90	Soil	EQS: copper (0.005 mg/l); mercury (0.0002 mg/l).
CPT1	0.60	Soil	EQS: copper (0.006 mg/l); lead (0.004 mg/l).
CPT3	0.20	Soil	GAC: chloromethane (0.011 mg/kg). EQS: copper (0.006 mg/l); lead (0.004 mg/l); zinc (0.024 mg/kg).
CPT4	0.50	Soil	EQS: copper (0.005 mg/l).
CPT6	0.30	Soil	EQS: copper (0.011 mg/l); lead (0.008 mg/l); zinc (0.020 mg/l).
BH1	0.50	Soil	GAC: chloromethane (0.013 mg/kg). EQS: copper (0.004 mg/l); chromium (0.028 mg/l); lead (0.005 mg/l).
BH2	1.00	Soil	EQS: copper (0.002 mg/l).
BH1 (19mm)	3.00	Water	EQS: ammoniacal nitrogen (1.16 mg/l).
BH1 (50mm)	12.00	Water	EQS: ammoniacal nitrogen (5.90 mg/l); DWS: boron (1.52 mg/l).
BH2 (50mm)	13.00	Water	EQS: ammoniacal nitrogen (12 mg/l); DWS: boron (2.08 mg/l).

Waste Assessment

3.1.15 The waste assessment for the proposed car park at the new Portishead Station and car park provides indicative information with respect to potential landfill disposal options if waste soil is required to be disposed off-site to landfill. From the limited amount of sampling undertaken, this does not form a comprehensive analysis of all material which could potentially require disposal but provides an initial understanding of soil quality at the specific locations sampled. Prior to the actual disposal of any soil from the site (if needed), further assessment may be required.

3.1.16 The WM3 and WAC assessment is summarised in Table 3.6. Based on the assessment, material sampled from TPPH03 (0.30 mbgl) and TPPH06 (0.90 mbgl) would likely be suitable for disposal in a non-hazardous landfill.

3.1.17 Inert WAC testing would be required for TPPH04 (0.40 mbgl) and TPHH05 (0.30 mbgl) to determine whether the waste is suitable for inert landfill. Hazardous WAC testing would be required for TPPH04 (1.1 mbgl) to determine whether the material would be suitable for hazardous waste landfill disposal or require pre-treatment to be suitable for this disposal route.

Table 3.6: Waste Assessment Summary - Portishead Station and Car Park

Exploratory Hole	Sample Depth (mbgl)	WM3 Classification from CatWaste	WAC Result	Comments
TPPH03	0.30	Non-hazardous	Material fails inert landfill criteria for exceedances in total organic carbon and antimony.	Material likely to be suitable for disposal in a non-hazardous waste landfill
TPPH04	0.40	Non-hazardous	-	-
TPPH04	1.10	Hazardous (HP14 – ecotoxic)*	-	-
TPPH05	0.30	Non-hazardous	-	-
TPPH06	0.90	Non-hazardous	Material fails inert landfill criteria for exceedance in total organic carbon.	Material likely to be suitable for disposal in a non-hazardous waste landfill

* Exceeds the classification criteria for lead and zinc.

Gas Monitoring and Assessment

3.1.18 Gas concentrations and groundwater levels were recorded in BH1 and BH2 during six monitoring rounds between November 2015 and January 2016. Measurements of borehole pressure (mbar), atmospheric pressure (mbar), gas flow (l/hr), water depth (mbgl), carbon dioxide (%vol), methane (%vol),

oxygen (%vol), Lower Explosive Limit (%LEL), carbon monoxide (ppm) and hydrogen sulphide (ppm) were recorded. Where groundwater levels were recorded at a level higher than the top of the standpipe response zones, gas data have been excluded from the initial assessment, since the data are not representative of *in situ* conditions. The gas monitoring record is provided in Table 3.7 and the raw gas monitoring results are included in Annex H.

Table 3.7: Gas Monitoring Record - Portishead Station and Car Park

Monitoring well	Monitoring Date	Response Zone Depth (mbgl)	Response Zone Strata (see notes)	Groundwater level (mbgl) (see notes)	Initial Gas Assessment Undertaken? (see notes)
BH1 (19mm)	19/11/2015	1.00 – 5.00	MG, TFD	2.57	Yes
BH1 (19mm)	24/11/2015	1.00 – 5.00	MG, TFD	NR	Yes
BH1 (19mm)	02/12/2015	1.00 – 5.00	MG, TFD	17.04	Yes
BH1 (19mm)	11/12/2015	1.00 – 5.00	MG, TFD	NR*	No*
BH1 (19mm)	16/12/2015	1.00 – 5.00	MG, TFD	1.96	Yes
BH1 (19mm)	08/01/2016	1.00 – 5.00	MG, TFD	1.60	Yes
BH1 (50mm)	19/11/2015	6.00 – 18.00	TFD	2.10	No – RZ flooded
BH1 (50mm)	24/11/2015	6.00 – 18.00	TFD	2.01	No – RZ flooded
BH1 (50mm)	02/12/2015	6.00 – 18.00	TFD	1.95	No – RZ flooded
BH1 (50mm)	11/12/2015	6.00 – 18.00	TFD	2.12	No – RZ flooded
BH1 (50mm)	16/12/2015	6.00 – 18.00	TFD	1.95	No – RZ flooded
BH1 (50mm)	08/01/2016	6.00 – 18.00	TFD	1.60	No – RZ flooded
BH2 (50mm)	19/11/2015	0.80 – 20.00	MG, TFD, MMG	1.70	Yes
BH2 (50mm)	24/11/2015	0.80 – 20.00	MG, TFD, MMG	NR	Yes
BH2 (50mm)	02/12/2015	0.80 – 20.00	MG, TFD, MMG	1.74	Yes

Table 3.7: Gas Monitoring Record - Portishead Station and Car Park

Monitoring well	Monitoring Date	Response Zone Depth (mbgl)	Response Zone Strata (see notes)	Groundwater level (mbgl) (see notes)	Initial Gas Assessment Undertaken? (see notes)
BH2 (50mm)	11/12/2015	0.80 – 20.00	MG, TFD, MMG	1.67	Yes
BH2 (50mm)	16/12/2015	0.80 – 20.00	MG, TFD, MMG	1.64	Yes
BH2 (50mm)	08/01/2016	0.80 – 20.00	MG, TFD, MMG	1.29	Yes

Notes:
MG = Made Ground, TFD = Tidal Flat Deposits, MMG = Mercia Mudstone Group, NR = Not Recorded, RZ = Response Zone.
* Factual report notes that the original paperwork disintegrated and hence gas monitoring results for this round are not available.

3.1.19 An initial assessment of the gas data presented in Table 3.8 has been undertaken based on the BS 8576:2013 guidance (British Standards Institution, 2013). According to the guidance, methane is explosive at concentrations of between 5% and 15% (volume fraction) in air. Methane levels exceeding 5% can therefore be considered as a trigger level for methane to be explosive. Carbon dioxide and carbon monoxide are highly toxic asphyxiants and can cause adverse health effects. The Health and Safety Executive has published long-term exposure limits (LTEL – 8 hour period) for work-related exposure of 0.5% v/v for carbon dioxide and 30 ppm for carbon monoxide. The short-term exposure limit (STEL – 15 minute period) is 1.5% v/v for carbon dioxide, and 200 ppm for carbon monoxide.

3.1.20 Based on the assessment, carbon dioxide concentrations in BH1 and BH2 exceed the LTEL and STEL guidelines. Carbon monoxide concentrations do not exceed the LTEL and STEL guidelines, and methane concentrations do not exceed the trigger level of 5%. The low (mostly zero) gas flows indicate that whilst carbon dioxide exceed the LTEL and STEL they are unlikely to present a significant risk.

Table 3.8: Initial Assessment of Gas Data - Portishead Station and Car Park

Monitoring Well	Response Zone Depth (mbgl)	Monitoring Date	Borehole Pressure (mbar)	Atmospheric Pressure (mbar)	Steady Gas Flow (l/hr)	Peak Gas Flow (l/hr)	Water Depth (mbgl)	Steady Carbon Dioxide (%vol)	Peak Carbon Dioxide (%vol)	Steady Methane (%vol)	Peak Methane (%vol)	Steady Oxygen (%vol)	Low Oxygen (%vol)	Steady LEL (%)	Peak LEL (%)	Steady Carbon Monoxide (ppm)	Peak Carbon Monoxide (ppm)	Steady Hydrogen Sulphide (ppm)	Peak Hydrogen Sulphide (ppm)
BH1	1.00 - 5.00	19/11/2015	1012	1012	0.0	0.0	2.57	2.4	5.0	0.0	0.0	18.5	11.9	0.0	0.0	0.0	0.0	0.0	0.0
BH1	1.00 - 5.00	24/11/2015	1013	1013	0.0	0.0	NR	2.7	3.8	0.0	0.0	17.9	15.0	0.0	0.0	0.0	0.0	0.0	0.0
BH1	1.00 - 5.00	02/12/2015	1020	1020	0.0	0.0	17.04	1.0	1.5	0.0	0.0	19.5	18.8	NR	NR	0.0	0.0	0.0	0.0
BH1	1.00 - 5.00	16/12/2015	1016	1016	0.0	0.0	1.96	1.9	2.9	0.0	0.0	19.4	17.2	NR	NR	0.0	0.0	0.0	0.0
BH1	1.00 - 5.00	08/01/2016	996	996	0.0	0.0	1.60	1.0	1.2	0.0	0.0	20.0	19.6	NR	NR	0.0	0.0	0.0	0.0
BH2	1.00 - 19.80	19/11/2015	1010	1011	0.1	0.4	1.70	1.9	3.4	0.0	0.0	18.9	18.2	0.0	0.0	0.0	1.0	1.0	1.0
BH2	1.00 - 19.80	24/11/2015	1011	1011	0.0	0.0	NR	0.5	1.3	0.1	0.3	20.9	20.4	2.0	6.0	0.0	1.0	0.0	0.0
BH2	1.00 - 19.80	02/12/2015	1020	1020	0.0	0.3	1.74	0.4	1.1	0.0	0.0	20.5	20.2	NR	NR	0.0	2.0	0.0	0.0

Table 3.8: Initial Assessment of Gas Data - Portishead Station and Car Park

Monitoring Well	Response Zone Depth (mbgl)	Monitoring Date	Borehole Pressure (mbar)	Atmospheric Pressure (mbar)	Steady Gas Flow (l/hr)	Peak Gas Flow (l/hr)	Water Depth (mbgl)	Steady Carbon Dioxide (%vol)	Peak Carbon Dioxide (%vol)	Steady Methane (%vol)	Peak Methane (%vol)	Steady Oxygen (%vol)	Low Oxygen (%vol)	Steady LEL (%)	Peak LEL (%)	Steady Carbon Monoxide (ppm)	Peak Carbon Monoxide (ppm)	Steady Hydrogen Sulphide (ppm)	Peak Hydrogen Sulphide (ppm)
BH2	1.00 - 19.80	11/12/ 2015	1022	1022	0.0	0.0	1.67	0.9	2.2	0.0	0.1	20.7	20.1	NR	NR	0.0	0.0	0.0	0.0
BH2	1.00 - 19.80	16/12/ 2015	1017	1017	0.0	0.0	1.64	0.2	0.2	0.0	0.0	20.8	20.7	NR	NR	0.0	0.0	0.0	0.0
BH2	1.00 - 19.80	08/01/ 2016	997	996	0.0	0.0	1.29	0.6	2.6	0.0	0.0	20.6	19.4	NR	NR	0.0	1.0	0.0	0.0

Notes:
NR = Not Recorded

Values in orange exceed the carbon dioxide long-term exposure limit (LTEL – 8 hour period) of 0.5% v/v for carbon dioxide.

Values in red exceed the carbon dioxide short-term exposure limit (STEL – 15 minute period) of 1.5% v/v for carbon dioxide.

3.2 Avon Road Bridge and Pill Station

3.2.1 The car park site at Pill Station comprises a generally flat area paved with macadam at the entrance and then aggregate. No significant contamination issues have been observed and the former station area does not appear to have any significant issues with regards to contamination. An intrusive investigation was undertaken in September 2015 by Structural Soils Limited (2015) on behalf of Arup to determine ground conditions on the sites of the proposed new Pill Station and the widening of the Avon Road Overbridge.

3.2.2 The following sections report the findings of the chemical testing and environmental monitoring undertaken at the investigation locations shown on the exploratory hole plan in Annex C2 and listed in Table 3.9 below.

Table 3.9: Summary of Investigation Locations - Avon Road Bridge and Pill Station

Exploratory Hole	Easting	Northing	Location	Bottom Depth (mbgl)	Groundwater encountered during investigation (mbgl)
FDTP1	352099.03	176250.57	Avon Road Bridge	1.10	Not encountered.
FDTP2	352102.74	176249.59	Avon Road Bridge	1.20	Not encountered.
BH3*	352106.54	176260.35	Avon Road Bridge	0.50	Not encountered.
BH3B (50 mm)	352102.00	176267.50	Avon Road Bridge	13.20 (13.00)**	First encountered at 0.80 mbgl.
BH4 (50 mm)	352374.90	176021.70	Pill Station	12.50 (10.50)**	First encountered at 1.80 mbgl.
BH5 (50 mm)	352408.70	176033.60	Pill Station	12.50 (6.00)**	First encountered at 2.00 mbgl.
BH6 (50 mm)	352408.70	176033.60	Pill Station	12.00 (12.00)**	First encountered at 2.00 mbgl.

Notes:
FDTP = Foundation Trial Pit.
* Inspection pit terminated at 0.50 mbgl due to proximity of services.
** Borehole standpipe depth is indicated in parentheses.

Ground Conditions

3.2.3 Exploratory hole logs for the investigation locations can be viewed in Annex D2 and a summary of the ground conditions is provided in Table 3.10.

Table 3.10: Summary of Ground Conditions - Avon Road Bridge and Pill Station

Stratum	Overall Description	Encountered Depths (mbgl)			
		Top		Base	
		From	To	From	To
Made ground	Tarmac / asphalt overlying reddish brown, black and grey gravelly clay / sand and sandy gravel with rootlets. Gravel consists of concrete, red mudstone, brick, cement, limestone, glass, ballast, sandstone and flint.	0.00	0.00	0.30	2.48
Mercia Mudstone Group	Reddish brown slightly sandy clay and thinly bedded and reddish brown mudstone comprising lenticular yellow fine to medium sandstone inclusions, gravel, quartz, calcite and black mineral and lithorelicts of gypsum.	0.50	3.45	>12.50	>13.20

Chemical Testing

3.2.4 Four samples from two exploratory boreholes and two trial pits were scheduled for chemical testing at MCERTS and UKAS accredited laboratories to assess the chemical nature of the soils. Leachability testing was also undertaken to determine if leachable substances are present in the soils which could adversely affect sensitive water receptors. Testing was carried out in accordance with testing suites specified in the UKSGI (ICE Publishing, 2012), and with MCERTS/UKAS standards where noted on the laboratory certificates enclosed in Annex E. A summary of soil contamination testing is given in Table 3.11.

Table 3.11: Summary of Soil Chemical Testing - Avon Road Bridge and Pill Station

Exploratory Hole	Sample Depth (mbgl)	Strata	Description of Strata	Testing (see notes)	
				S*	L
BH3 (50 mm)	0.20	(P)MG	Dark reddish brown slightly silty very gravelly sand with frequent rootlets. Sand is fine to coarse. Gravel is subangular fine to coarse brick and sandstone.	✓	✓

Table 3.11: Summary of Soil Chemical Testing - Avon Road Bridge and Pill Station

Exploratory Hole	Sample Depth (mbgl)	Strata	Description of Strata	Testing (see notes)	
				S*	L
BH3B (50 mm)	0.30	MG	Black to grey clayey gravelly sand. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse brick, limestone, sandstone and flint.	✓	✓
FDTP1	0.90	(P)MG	Dark reddish brown very clayey sand with occasional rootlets. Sand is fine to coarse.	✓	✓
FDTP2	0.30	MG	Dark brownish black clayey sandy gravel with a low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse brick, concrete, limestone and sandstone. Cobbles are angular tabular bricks up to 200mm. Boulders are angular tabular brick and concrete up to 250mm.	✓	✓

Notes:
(P)MG = Possible Made Ground, MG = Made Ground,
S = Soil (includes asbestos screening), L = Leachate

3.2.5 Additionally, groundwater samples collected from BH3B, BH4 and BH6 during the gas and groundwater monitoring programme undertaken between November 2015 and January 2016 were scheduled for chemical testing. Testing of groundwater samples was broadly carried out in accordance with groundwater testing suite listed in the UKSGI (ICE Publishing, 2012), and with MCERTS/UKAS standards where noted on the laboratory certificates enclosed in Annex E. The summary of groundwater chemical testing is presented in Table 3.12.

Table 3.12: Summary of Groundwater Chemical Testing - Avon Road Bridge and Pill Station

Exploratory Hole	Sample Top Depth (mbgl)	Response Zone Depth (mbgl)	Response Zone Strata
BH3B (50mm)	9.00	1.00 – 13.00	Mercia Mudstone Group
BH4 (50mm)	6.00	1.50 – 10.50	Made ground and Mercia Mudstone Group
BH6 (50mm)	10.00	8.50 – 12.00	Mercia Mudstone Group

Contamination Assessment

3.2.6 The assessment of soil, leachate and groundwater results has been undertaken as per the methodology described in Section 3.1.3. All assessment criteria used for the assessment of soils, leachate and groundwater results are listed in Annex G. Exceedances against assessment criteria are listed in Table 3.13. Asbestos in the form of loose chrysotile fibres was detected in one sample at 0.30 mbgl at 0.019% w/w from the foundation trial pit FDTP2. Asbestos was not detected in the other samples analysed. There are no exceedances in the groundwater sampled from BH4.

Table 3.13: Exceedances against GAC / CWSC Assessment Criteria - Avon Road Bridge and Pill Station

Exploratory Hole	Sample Depth (mbgl)	Sample Type	Exceedances against GAC / CWSC
FDTP1	0.90	Soil	EQS: copper (0.003 mg/l).
FDTP2	0.30	Soil	S4UL: benzo(b)fluoranthene (7.87 mg/kg); dibenzo(ah)anthracene (0.78 mg/kg); EQS: copper (0.006 mg/l); chromium (0.005 mg/l); lead (0.007 mg/l).
BH3	0.20	Soil	EQS: copper (0.005 mg/l).
BH3B (50mm)	0.30	Soil	EQS: copper (0.006 mg/l); lead (0.002 mg/l).
BH6 (50mm)	10.00	Water	EQS: copper (0.003 mg/l); benzo(a)pyrene (0.02 µg/l); benzo(b)fluoranthene (0.03 µg/l); benzo(g,h,i)perylene (0.02 µg/l); benzo(k)fluoranthene (0.03 µg/l); indeno(1,2,3-cd)pyrene (0.02 µg/l).

Gas Monitoring and Assessment

3.2.7 Gas concentrations and groundwater levels were recorded in BH3B, BH4, BH5 and BH6 during six monitoring rounds between November 2015 and January 2016. Where groundwater levels were recorded at a level higher than the top of the standpipe response zones, gas data have been excluded from the initial assessment, since the data are not representative of *in situ* conditions. The gas monitoring record is provided in Table 3.14 and the raw gas monitoring results are included in Annex H.

Table 3.14: Gas Monitoring Record - Avon Road Bridge and Pill Station

Monitoring well	Monitoring Date	Response Zone Depth (mbgl)	Response Zone Strata (see notes)	Groundwater level (mbgl) (see notes)	Initial Gas Assessment Undertaken? (see notes)
BH3B (50mm)	19/11/2015	1.00 – 13.00	MMG	4.37	Yes
BH3B (50mm)	24/11/2015	1.00 – 13.00	MMG	4.44	Yes
BH3B (50mm)	02/12/2015	1.00 – 13.00	MMG	4.17	Yes
BH3B (50mm)	11/12/2015	1.00 – 13.00	MMG	4.25	Yes
BH3B (50mm)	16/12/2015	1.00 – 13.00	MMG	4.01	Yes
BH3B (50mm)	08/01/2016	1.00 – 13.00	MMG	3.44	Yes
BH4 (50mm)	19/11/2015	1.50 – 10.50	MG, MMG	3.01	Yes
BH4 (50mm)	24/11/2015	1.50 – 10.50	MG, MMG	3.57	Yes
BH4 (50mm)	02/12/2015	1.50 – 10.50	MG, MMG	3.54	Yes
BH4 (50mm)	11/12/2015	1.50 – 10.50	MG, MMG	3.85	Yes
BH4 (50mm)	16/12/2015	1.50 – 10.50	MG, MMG	3.68	Yes
BH4 (50mm)	08/01/2016	1.50 – 10.50	MG, MMG	3.17	Yes
BH5 (50mm)	19/11/2015	3.00 – 6.00	MMG	ND	-
BH5 (50mm)	24/11/2015	3.00 – 6.00	MMG	5.44	Yes
BH5 (50mm)	02/12/2015	3.00 – 6.00	MMG	4.45	Yes
BH5 (50mm)	11/12/2015	3.00 – 6.00	MMG	4.64	Yes
BH5 (50mm)	16/12/2015	3.00 – 6.00	MMG	4.57	Yes

Table 3.14: Gas Monitoring Record - Avon Road Bridge and Pill Station

Monitoring well	Monitoring Date	Response Zone Depth (mbgl)	Response Zone Strata (see notes)	Groundwater level (mbgl) (see notes)	Initial Gas Assessment Undertaken? (see notes)
BH5 (50mm)	08/01/2016	3.00 – 6.00	MMG	4.12	Yes
BH6 (50mm)	19/11/2015	8.50 – 12.00	MMG	9.63, UTM	-
BH6 (50mm)	24/11/2015	8.50 – 12.00	MMG	9.79	Yes
BH6 (50mm)	02/12/2015	8.50 – 12.00	MMG	UTM	-
BH6 (50mm)	11/12/2015	8.50 – 12.00	MMG	UTM	-
BH6 (50mm)	16/12/2015	8.50 – 12.00	MMG	UTM	-
BH6 (50mm)	08/01/2016	8.50 – 12.00	MMG	9.53	Yes

Notes:
MG = Made Ground, MMG = Mercia Mudstone Group, NR = Not Recorded, UTM = Unable To Monitor (access restrictions and flooding of borehole casing noted in factual report), ND = No Data Available.

3.2.8 An initial assessment of the gas data presented in Table 3.15 has been undertaken based on the BS 8576:2013 guidance (British Standards Institution, 2013). Based on the assessment, carbon dioxide concentrations exceed LTEL guidelines in all boreholes and STEL guidelines in BH3B and BH4. Carbon monoxide concentrations exceed the LTEL guidelines in BH4 and BH5, and STEL guidelines in BH4 though at peak state. Methane concentrations do not exceed the trigger level of 5%.

Table 3.15: Initial Assessment of Gas Data - Avon Road Bridge and Pill Station

Monitoring Well	Response Zone Depth (mbgl)	Monitoring Date	Borehole Pressure (mbar)	Atmospheric Pressure (mbar)	Steady Gas Flow (l/hr)	Peak Gas Flow (l/hr)	Water Depth (mbgl)	Steady Carbon Dioxide (%vol)	Peak Carbon Dioxide (%vol)	Steady Methane (%vol)	Peak Methane (%vol)	Steady Oxygen (%vol)	Low Oxygen (%vol)	Steady LEL (%)	Peak LEL (%)	Steady Carbon Monoxide (ppm)	Peak Carbon Monoxide (ppm)	Steady Hydrogen Sulphide (ppm)	Peak Hydrogen Sulphide (ppm)
BH3B (50mm)	1.00 – 13.00	19/11/2015	N/A	N/A	0.0	0.0	4.37	1.3	1.4	0.0	0.0	16.8	16.8	0.0	0.0	0.0	0.0	0.0	0.0
BH3B (50mm)	1.00 – 13.00	24/11/2015	1011	1011	0.0	0.0	4.44	1.7	1.8	0.0	0.0	17.7	17.4	0.0	0.0	0.0	0.0	0.0	0.0
BH3B (50mm)	1.00 – 13.00	02/12/2015	1019	1019	0.0	0.0	4.17	1.7	1.7	0.0	0.0	17.7	17.6	-	-	0.0	0.0	0.0	0.0
BH3B (50mm)	1.00 – 13.00	11/12/2015	1021	1021	0.0	0.0	4.25	2.3	2.3	0.0	0.0	18.0	17.8	-	-	0.0	0.0	0.0	0.0
BH3B (50mm)	1.00 – 13.00	16/12/2015	1017	1017	0.0	0.0	4.01	2.2	2.2	0.0	0.0	17.5	17.5	-	-	0.0	0.0	0.0	0.0
BH3B (50mm)	1.00 – 13.00	08/01/2016	996	996	0.0	0.0	3.44	1.5	1.6	0.0	0.0	18.6	18.4	-	-	0.0	0.0	0.0	0.0
BH4 (50mm)	1.50 – 10.50	19/11/2015	1010	1010	0.0	-0.1*	3.01	0.1	0.1	0.0	0.0	20.9	20.9	0.0	0.0	7.0	140.0	0.0	0.0
BH4 (50mm)	1.50 – 10.50	24/11/2015	1007	1007	0.0	-0.6*	3.57	0.1	0.1	0.0	0.0	20.9	19.6	0.0	0.0	39.0	>500	0.0	1.0

Table 3.15: Initial Assessment of Gas Data - Avon Road Bridge and Pill Station

Monitoring Well	Response Zone Depth (mbgl)	Monitoring Date	Borehole Pressure (mbar)	Atmospheric Pressure (mbar)	Steady Gas Flow (l/hr)	Peak Gas Flow (l/hr)	Water Depth (mbgl)	Steady Carbon Dioxide (%vol)	Peak Carbon Dioxide (%vol)	Steady Methane (%vol)	Peak Methane (%vol)	Steady Oxygen (%vol)	Low Oxygen (%vol)	Steady LEL (%)	Peak LEL (%)	Steady Carbon Monoxide (ppm)	Peak Carbon Monoxide (ppm)	Steady Hydrogen Sulphide (ppm)	Peak Hydrogen Sulphide (ppm)
BH4 (50mm)	1.50 – 10.50	02/12/2015	1018	1018	0.0	0.0	3.54	0.2	0.2	0.0	0.0	13.7	13.7	-	-	84.0	173.0	0.0	0.0
BH4 (50mm)	1.50 – 10.50	11/12/2015	1021	1021	0.0	0.0	3.85	0.3	0.4	0.0	0.0	16.3	15.8	-	-	1.0	1.0	0.0	0.0
BH4 (50mm)	1.50 – 10.50	16/12/2015	1016	1016	0.0	0.0	3.68	0.4	0.6	0.0	0.0	16.3	14.6	-	-	1.0	1.0	0.0	0.0
BH4 (50mm)	1.50 – 10.50	08/01/2016	994	994	0.0	0.0	3.17	1.2	1.5	0.0	0.0	14.9	14.5	-	-	0.0	0.0	0.0	0.0
BH5 (50mm)	3.00 – 6.00	24/11/2015	1007	1008	0.0	0.4	5.44	0.2	0.2	0.0	0.0	17.7	17.7	0.0	0.0	29.0	58.0	0.0	0.0
BH5 (50mm)	3.00 – 6.00	02/12/2015	1018	1018	0.0	1.7	4.45	1.4	1.4	0.0	0.0	14.5	14.4	-	-	1.0	23.0	0.0	0.0
BH5 (50mm)	3.00 – 6.00	11/12/2015	1021	1021	0.0	0.1	4.64	0.9	0.9	0.0	0.0	17.7	17.7	-	-	0.0	1.0	0.0	0.0
BH5 (50mm)	3.00 – 6.00	16/12/2015	1016	1016	0.0	0.0	4.57	0.7	0.7	0.0	0.0	18.2	18.2	-	-	1.0	1.0	0.0	0.0

Table 3.15: Initial Assessment of Gas Data - Avon Road Bridge and Pill Station

Monitoring Well	Response Zone Depth (mbgl)	Monitoring Date	Borehole Pressure (mbar)	Atmospheric Pressure (mbar)	Steady Gas Flow (l/hr)	Peak Gas Flow (l/hr)	Water Depth (mbgl)	Steady Carbon Dioxide (%vol)	Peak Carbon Dioxide (%vol)	Steady Methane (%vol)	Peak Methane (%vol)	Steady Oxygen (%vol)	Low Oxygen (%vol)	Steady LEL (%)	Peak LEL (%)	Steady Carbon Monoxide (ppm)	Peak Carbon Monoxide (ppm)	Steady Hydrogen Sulphide (ppm)	Peak Hydrogen Sulphide (ppm)
BH5 (50mm)	3.00 – 6.00	08/01/2016	993	993	0.0	0.0	4.12	0.4	0.6	0.0	0.0	20.0	19.7	-	-	0.0	0.0	0.0	0.0
BH6 (50mm)	8.50 – 12.00	24/11/2015	1008	1008	0.0	0.0	9.79	1.4	1.4	0.0	0.0	17.0	17.0	0.0	0.0	0.0	0.0	0.0	0.0
BH6 (50mm)	8.50 – 12.00	08/01/2016	995	995	0.0	0.0	9.53	0.4	0.4	0.0	0.0	14.0	14.0	-	-	0.0	0.0	0.0	0.0

Notes:
NR = Not Recorded
Values in orange exceed the long-term exposure limit (LTEL – 8 hour period) of 0.5% v/v for carbon dioxide, and 30 ppm for carbon monoxide.
Values in red exceed the short-term exposure limit (STEL – 15 minute period) of 1.5% v/v for carbon dioxide, and 200 ppm for carbon monoxide.
Yellow cells highlight elevated levels of carbon monoxide.
* Initial negative flow rate recorded – indicates the gas pressure within the standpipe is below that of atmospheric pressure.

3.3 Disused Route Section Track Ballast Testing

3.3.1 The DCO Scheme involves renovating a stretch of disused railway track. This would include storing track ballast until the new railway is constructed and then transporting the ballast via the new railway to a Network Rail treatment centre.

3.3.2 A trackbed investigation was carried out in 2014, along the trackbed of the disused railway between Portbury Dock Junction and Portishead to assess the current condition of the trackbed and to confirm the depth to the underlying natural ground beneath the track (URS, 2014). 24 Automatic Ballast Samples ("ABS") were collected and underwent chemical testing. A subsequent trackbed investigation was undertaken between September and August 2015 throughout the DCO Scheme (Arup, 2016) whereby 108 ABS samples were taken from within the 4ft of the existing track. A total of 35 samples were also taken from shallow and deep trial pits within 4ft of the existing track. Selected samples were scheduled for chemical testing.

3.3.3 The results of the chemical analysis have been compared to C4SLs and S4ULs (unless otherwise stated) for a Public Open Space (not near residential) scenario. Table 1 in Annex I shows the results of the chemical testing undertaken to date. The only exceedances are for lead, which was recorded up to 2066 mg/kg compared to the C4SL of 1300 mg/kg. In the disused section of track, approximately 29% of samples exceeded the C4SL, whereas less than 2% exceeded in the rest of the trackbed. It is recommended that further chemical analysis be undertaken to include further contaminants such as polycyclic aromatic hydrocarbons ("PAH").

SECTION 4

Risk Assessment

4.1 Introduction

4.1.1 This section summarises the desk study and ground investigation information (baseline) and presents a source-pathway-receptor risk assessment based on the government guidance on Land Contamination: Risk Management ("LCRM") published by the Environment Agency (2019). The risk assessment methodology is set out in Annex J.

4.2 Potential sources of contamination

4.2.1 The route of the DCO Scheme was an established railway corridor for a considerable period and as such there is potential for the underlying ground to be affected by contaminants associated with railway use. Additionally, ground investigations have identified contamination some soil and groundwater contamination likely associated with railway use and land uses.

4.2.2 Key potential sources of contamination (starting from Portishead) have been identified as follows:

- A small gasworks, nail factory, paper bag factory, phosphorus factory – all located outside the footprint of the DCO Scheme and since redeveloped, so not considered further;
- Priory Farm Landfill located between the A369 and the disused railway. The railway forms the northern boundary of the landfill. This is an historical landfill operating in the late 1980s;
- Former coal mining activities, and various former mills and metal works in the Ashton Vale;
- Landfills near Ashton Gate (Bedminster Down, South Liberty Lane Brickworks, Cala Trading Estate, Viridor Long Ashton, Land at Parsonage Farm, Phase 2 of Landfill site at Parsonage Farm, and Phase 3 landfill at Ashton Vale) (the works between Ashton Junction and Parson Street Junction to be undertaken by Network Rail under their permitted development rights and do not form part of the DCO Application);
- Track ballast – elevated levels of lead have been identified, particularly in the disused section of track;
- Portishead Station and Car Park site – elevated levels of contaminants (lead and chloromethane) and leachable metals have been identified in soils. There is some minor contamination of groundwater (ammoniacal nitrogen and boron). Additionally, elevated levels of carbon dioxide gas above LTEL and STEL guidelines has been identified from Made Ground and underlying strata at the site of the proposed new Portishead Station. The site is close to the power station ash landfill, located to the north of the railway, east of Haven View;

- Avon Road Bridge – elevated levels of PAH contaminants and leachable metals have been identified in soils. Asbestos has also been detected; and
- Pill Station site – elevated levels of leachable metals have been identified in soils. Some metal and PAH contamination has been identified in groundwater.

4.3 Potential receptors

4.3.1 The potential receptors to the contamination applicable to the proposed development of the DCO Scheme are as follows:

- Ground workers and construction workers during the construction of the DCO Scheme;
- Future site users including maintenance workers during the operation of the DCO Scheme;
- Adjacent site users including residents;
- Surface water and watercourses; and
- Underlying Secondary A (River Terrace Deposits) and Secondary B (Mercia Mudstone Group) Aquifers.

4.4 Potential pathways

4.4.1 The potential pathways relevant to human health receptors are:

- Dermal contact with contaminated soil;
- Ingestion of contaminated soil; and,
- Inhalation of contaminated soil dusts and / or vapours.

4.4.2 The potential pathways relevant to controlled waters is:

- Leaching of soil contaminants and surface run-off; and
- Lateral and / or vertical migration of contaminants via soils.

4.5 Source-Pathway-Receptor Risk Assessment

4.5.1 Based on the potential contaminant sources, receptors and pathways outlined above, potential pollutant linkages have been identified in a source-pathway-receptor risk assessment presented in Table 4.1. The risks presented for the DCO Scheme assume that good construction practice measures are applied and that the likelihood of the risk being realised is adjusted accordingly. Annex J defines the risk assessment methodology. Where “no likelihood” is stated this means there is no pollutant linkage and therefore no risk. In Table 4.1, the acronyms CoCP and CEMP refer to the Code of Construction Practice and the Construction Environment Management Plan. The Master CoCP and the CEMP are produced in the ES Appendices 4.1 and 4.2 and the contractors will be required to draft their own CEMP compliant with the Master documents.

Table 4.1: Source Pathway Receptor Summary

Source	Pathway	Receptor	Consequence		Likelihood		Risk		Comments
			Baseline	Scheme	Baseline	Scheme	Baseline	Scheme	
Contaminants in track ballast	Lateral and vertical migration of contaminants	Surface Water Secondary B Aquifer	Medium	Medium	Unlikely	Unlikely	Low	Low	Removal of the ballast will follow NRIL standards, and based on the concentrations of contaminants encountered the works are considered very unlikely to cause contamination of local groundwater or surface water.
	Direct contact and ingestion of contaminants	Construction workers	n/a	Medium	n/a	No likelihood	n/a	No risk	Removal of the ballast will follow NRIL standards. Protection of construction workers and adjacent site users will be addressed in the site health and safety plan, the CoCP and the CEMP.
		Adjacent/ current site users	Medium (current users)	Medium (adjacent users)	Unlikely (current users)	No likelihood (adjacent users)	Low (current users)	No risk	
	Storage of removed ballast (resulting in lateral and vertical migration of contaminants)	Surface Water Secondary B Aquifer	n/a	Mild	n/a	Unlikely	Low	Low	The storage will require management, including pre and post ground analysis, basal and covering layers and control of runoff and will be addressed in the site health and safety plan, the CoCP and the CEMP.

Table 4.1: Source Pathway Receptor Summary

Source	Pathway	Receptor	Consequence		Likelihood		Risk		Comments
			Baseline	Scheme	Baseline	Scheme	Baseline	Scheme	
Made Ground at Portishead Station and Car Park site identified contamination	Direct contact and ingestion of contaminants	Construction workers Adjacent site users	Medium	Medium	Unlikely	Unlikely	Low	Low	Protection of construction workers and adjacent site users will be addressed in the site health and safety plan, the CoCP and the CEMP. Piling risk assessment will be required to address potential groundwater contamination issues. Gas risk is low based on ground investigation. Further measures will be required to eliminate this risk during construction.
	Lateral and vertical migration of contaminants	Surface Water Secondary A and B Aquifers	Medium	Medium	Unlikely	Unlikely	Low	Low	
	Migration of gas (asphyxiation)	Construction workers	n/a	Severe	n/a	Unlikely	n/a	Moderate/ Low	
Priory Farm Landfill	Migration of landfill gas (asphyxiation and explosion risk)	Construction workers	n/a	Severe	n/a	Unlikely	n/a	Moderate /Low	The ground conditions are not fully known. This risk is for gas and leachate migration from the landfill into excavations during construction. Protection of construction workers and adjacent site users will be addressed in the site health and safety plan, the CoCP and the CEMP.
	Lateral migration of contaminants from landfill via groundwater	Construction workers	n/a	Medium	n/a	Unlikely	n/a	Low	

Table 4.1: Source Pathway Receptor Summary

Source	Pathway	Receptor	Consequence		Likelihood		Risk		Comments
			Baseline	Scheme	Baseline	Scheme	Baseline	Scheme	
Avon Road Bridge identified contamination	Direct contact and ingestion of contaminants, and inhalation of asbestos	Construction workers Adjacent site users	Medium	Medium	Unlikely	Unlikely	Low	Low	Protection of construction workers and adjacent site users will be addressed in the site health and safety plan, the CoCP and the CEMP. Works will need to consider the Control of Asbestos Regulations 2012. Piling risk assessment will be required to address potential groundwater contamination issues. Gas risk is low based on ground investigation. Further measures will be required to eliminate this risk during construction.
	Lateral and vertical migration of contaminants	Surface Water Secondary B Aquifer	Medium	Medium	Unlikely	Unlikely	Low	Low	
	Migration of gas (asphyxiation)	Construction workers	n/a	Severe	n/a	Unlikely	n/a	Moderate/ Low	

Table 4.1: Source Pathway Receptor Summary

Source	Pathway	Receptor	Consequence		Likelihood		Risk		Comments
			Baseline	Scheme	Baseline	Scheme	Baseline	Scheme	
Pill Station identified contamination	Direct contact and ingestion of contaminants, and inhalation of asbestos	Construction workers Adjacent site users	Medium	Medium	Unlikely	Unlikely	Low	Low	Protection of construction workers and adjacent site users will be addressed in the site health and safety plan, the CoCP and the CEMP. Piling risk assessment will be required to address potential groundwater contamination issues. Gas risk is low based on ground investigation. Further measures will be required to eliminate this risk during construction.
	Lateral and vertical migration of contaminants	Surface Water Secondary B Aquifer	Medium	Medium	Unlikely	Unlikely	Low	Low	
	Migration of gas (asphyxiation)	Construction workers	n/a	Severe	n/a	Unlikely	n/a	Moderate/ Low	
Former coal mining activities, and various former mills and metal works in the Ashton Vale	Direct contact and ingestion of contaminants	Construction workers	Medium	Medium	Unlikely	Unlikely	Low	Low	The ground conditions are not fully known at the site of the proposed pedestrian and cycle ramp. There is a likelihood that contaminants are present in soils which could be mobilised during the construction phase of the scheme unless mitigation measures are implemented.
		Adjacent site users	Medium	Medium	Unlikely	Unlikely	Low	Low	
	Lateral and vertical migration of contaminants	Surface Water Secondary B Aquifer	Medium	Medium	Unlikely	Unlikely	Low	Low	

Table 4.1: Source Pathway Receptor Summary

Source	Pathway	Receptor	Consequence		Likelihood		Risk		Comments
			Baseline	Scheme	Baseline	Scheme	Baseline	Scheme	
Landfills near Ashton Gate	Migration of landfill gas (asphyxiation and explosion risk)	Construction workers	n/a	Severe	n/a	Unlikely	n/a	Moderate/ Low	The ground conditions are not fully known at the site of the proposed pedestrian and cycle ramp.

4.6 Discussion of risk assessment

Track ballast

4.6.1 The construction of the new railway along the disused corridor mainly comprises replacement of the ballast, minor modifications to existing earthworks and drainage, and very localised foundations for specific structures. Whilst some of the ballast is slightly contaminated, notably with lead, the removal of the ballast will follow Network Rail ("NRIL") standards; and based on the concentrations of contaminants encountered, the works are considered very unlikely to cause contamination of local groundwater or surface water. As such, the operation is unlikely to impact on the underlying geology or hydrogeology in terms of regional and local flows or groundwater quality. There will be no impact on the railway from underlying ground conditions and the railway construction will not be sensitive to any residual contamination beneath the existing railway corridor. The baseline condition is assessed as **low risk** (considered **unlikely**, consequence **medium**). The track ballast represents a risk to site users, adjacent users and construction workers, albeit this is considered a low risk. Risks to construction workers and adjacent site users will be addressed by the site health and safety plan, CoCP and the CEMP.

4.6.2 The ballast that will be removed and will be temporarily stored either beside the tracks or at a construction compound prior to removal for treatment and reuse at an off-site facility. It is likely that a waste exemption (non-waste framework directive exemptions for the temporary storage at the place of production) will be required for the storage. Note that the place of production is considered to be the DCO Scheme as a whole, including temporary construction compounds. Whilst the ballast is not grossly contaminated (mostly metal and some organic contamination) the storage will require management, including pre and post ground analysis, basal and covering layers, and the control of runoff. Currently there is no storage or ballast and therefore there is **no risk**. Taking into account the planned mitigation, the probability of risk is considered to be **unlikely** and the consequence **minor**, indicating a **very low risk.**

Ground Investigation requirements

4.6.3 Further investigation of the track ballast is recommended, to include PAHs and an assessment of leachability of contaminants (to inform storage considerations). Areas used for the storage of track ballast will require investigation to determine baseline conditions.

Portishead Station

4.6.4 Construction of the station at Portishead is on land that has residual contamination arising from historic land uses. The nature of the proposed development, being a relatively small station building and platforms, is such that it is not expected that the underlying ground conditions will have a material impact on construction and use of the building. Constraints relating to any contamination will be addressed through the project design. For example, further ground investigation and risk assessment, including piling risk assessments will be required. The baseline condition is assessed as **low risk** (considered **unlikely**, consequence **medium**). For the DCO Scheme, taking into account further investigation and design it is considered there is no change to this.

4.6.5 Ground investigation has shown there to be elevated concentrations of carbon dioxide within the ground, although the risk to humans is considered low as there is no significant flow of ground gases. However, given the severe consequences (i.e. asphyxiation) this will require measures to be taken during construction to inform this risk (such as further monitoring) and to eliminate, where necessary (control of access to excavations and use of gas alarms). These measures are considered good construction practice and therefore this risk is not considered within the ES.

4.6.6 A Wessex Water sewer passes under the proposed site of Portishead station. Piling works will be managed in such a way as to avoid the known location and route of the sewer, which will be protected by a transfer slab. As the site currently exists, as there is no construction work being undertaken, the baseline is assessed as **no risk**. Rupture of the sewer during construction is considered unlikely and the consequences mild, leading to a very low risk.

4.6.7 There is a disused Ministry of Defence oil pipeline under the proposed site for car park B. As there is no purge certificate available for this pipeline, it will be treated as a live pipeline during construction with standard industry practice measures taken to avoid a pollution incident. The precise location and route of this pipeline will be confirmed through survey and trenching. Currently as no detail is known about the pipeline, it is considered that the pipeline may represent a residual source of contamination and due to corrosion may leak over time. The baseline risk is assessed as **unlikely** probability and **moderate** consequence, indicating a **low risk**. For the DCO Scheme, taking into account further investigation and design it is considered there is no change to this risk.

Ground Investigation requirements

4.6.8 Further investigation is required to include investigation of the location of the oil pipeline. Further ground gas monitoring is recommended. Trial pits are recommended to further investigate sources of contamination.

Disused Track – Priory Farm Landfill

4.6.9 The DCO Scheme works in the vicinity of the Priory Farm Landfill consist of ballast replacement and new track, and clearance/ reformation of ditches. Should ground gas and leachate be preset in the landfill there is the potential for it to migrate into excavations. However, it is considered that gas and leachate from this landfill, should they be present are unlikely to have a material effect on the DCO Scheme, although gas monitoring during construction should be undertaken, as a health and safety precaution. The risk of gas/leachate migration is considered an **unlikely** probability with severe consequence, and therefore a **moderate/low risk**. However, standard industry practice measures, such as further investigation and, if required, gas alarms during construction will aim to eliminate this risk completely.

4.6.10 The Elm Tree Farm Landfill is not considered to present a potential impact to the DCO Scheme due to the distance (c250 m) and intervening presence of housing.

Ground Investigation requirements

4.6.11 Further ground gas monitoring and groundwater monitoring is recommended.

Avon Road Bridge

4.6.12 The ground conditions at Avon Road Underbridge site and embankment will be further investigated as part of the design for the widened structure and changes to the embankment profile. The works consist of a large temporary cutting to install the retaining walls, excavation and benching of the existing embankments, and piling for a king post wall. Ground investigation did note some contamination, most notably asbestos. However, good construction practice and compliance with the Control or Asbestos Regulations 2012 will mean that the risk during construction is the same as for baseline. Ground investigation has shown there to be elevated concentrations of carbon dioxide within the ground, although the risk to humans is considered low as there was no significant flow of ground gases observed during the monitoring period. However, given the severe consequences (i.e. asphyxiation) this will require measures to be taken during construction to eliminate this risk (such as gas alarms and control of access to excavations). These measures are considered good construction practice and therefore this risk is not considered to vary for baseline or the DCO Scheme.

Ground Investigation requirements

4.6.13 No additional ground investigation is required at this location.

1.1.1 Pill Station and car park

4.6.14 Renovation of the station at Pill will have no impact on the underlying geology. The station platforms are already in existence and will be replaced. The cutting slope to the south of the station will be designed to form a more stable slope. Construction of the station will need to take account of the ground conditions, but it is not anticipated that these would pose any material constraints on construction. Further investigation of the station area is required, and findings of the investigation will be used to inform the design. The baseline condition is assessed as low risk (considered unlikely, consequence medium). For the DCO Scheme, it is considered there is no change to this risk.

4.6.15 Ground investigation has shown there to be elevated concentrations of carbon dioxide within the ground, although the risk to humans is considered low as there is no significant flow of ground gases. However, given the severe consequences (i.e. asphyxiation) this will require measures to be taken during construction to eliminate this risk (such as further monitoring, gas alarms and control of access to excavations).

Ground Investigation requirements

4.6.16 The ground investigation planned for Pill station was not completed so further investigation, trail pits, boreholes, soil, groundwater and gas analysis are required.

Ashton Vale

4.6.17 Currently the plans are to construct a cycle ramp from Ashton Vale Level Crossing to Ashton Road. It is unlikely that the works will be significantly affected by contamination although existing ground investigation data should be assessed ahead of the works.

4.7 Gap Analysis

- Envirocheck reports have not been reviewed (by Jacobs) for the area between Pill Station and Parson Street Junction although it is understood that NRIL has reviewed their databank for this section of route;
- Further investigation of the track ballast is recommended, to include PAHs and an assessment of leachability of contaminants (to inform storage design). Areas used for the storage of track ballast will require investigation to determine baseline conditions.
- Portishead Station - Further investigation is required to include investigation of the location of the oil pipeline. Further ground gas monitoring is recommended. Trial pits are recommended to further investigate sources of contamination.
- Disused track – Priory Farm Landfill - Further ground gas monitoring and groundwater monitoring is recommended.
- Pill Station - The ground investigation planned for Pill station was not completed so further investigation, trail pits, boreholes, soil, groundwater and gas analysis are required.
- Ashton Vale – existing ground investigation data should be re-assessed to inform the design of the pedestrian and cycle ramp.

SECTION 5

Conclusions and Recommendations

5.1 Conclusions

5.1.1 Desk study and ground investigation has shown there to be several sources of contamination in the area of the DCO Scheme that may present a risk to humans and /or the environment. Most of these risks are considered low, and in most cases further investigation is required to inform the assessment of such risks. The majority of the risks identified can be mitigated through good construction practice. Risks to construction workers (and adjacent residents) should be managed through the site health and safety plan (as detailed in the CoCP and CEMP) which will detail mitigation such as dust prevention and personal protective equipment.

Tack ballast

5.1.2 The construction of the new railway along the disused corridor mainly comprises replacement of the ballast, minor modifications to existing earthworks and drainage, and very localised foundations for specific structures. Whilst some of the ballast is moderately contaminated, the removal of the ballast will follow NRIL standards, and based on the concentrations of contaminants encountered the works are considered very unlikely to cause contamination of local groundwater or surface water. The ballast requires temporary storage, prior to removal by rail for cleaning and reuse. This temporary storage will require management of runoff and drainage control.

Portishead and Pill Station

5.1.3 The proposed station at Portishead and the renovation of Pill Station are both on brownfield sites. However, with the adoption of good construction practices, the contamination is unlikely to have an effect on the development.

5.1.4 A Wessex Water sewer passes under the proposed site of Portishead station. Piling works will be managed in such a way as to avoid the known location and route of the sewer, which will be protected by a transfer slab.

5.1.5 There is a disused Ministry of Defence oil pipeline under the proposed site for car park B at Portishead Station. Further investigation is required to locate this pipeline precisely.

Disused Track – Priory Farm Landfill

5.1.6 The DCO Scheme works in the vicinity of the Priory Farm Landfill consist of ballast replacement and new rails, and clearance/ reformation of ditches. Should leachate or gas be present within the landfill this represents a risk to the works, in particular excavations. Further ground investigation is required to inform this risk and design mitigation measures.

Avon Road Bridge

5.1.7 The works consist of a large temporary cutting to install the retaining walls, excavation and benching of the existing embankments and piling for a king post wall. Ground investigation did note some asbestos contamination. Works will need to comply with the Control of Asbestos Regulations 2012.

Ashton Vale

5.1.8 Currently the plans are to construct a pedestrian and cycle ramp from Ashton Vale Level Crossing to Ashton Road. It is unlikely that the works will be significantly affected by contamination although existing ground investigation data should be assessed ahead of the works.

5.2 Recommendations

5.2.1 The DCO permission will likely contain a requirement for a written scheme to address the contamination of any land, and including groundwater, within the Order limits, which will include an investigation and assessment report. These written scheme and assessment reports will require approval by the planning authority after consultation with the EA and Local Authorities. The data recommended for this report is listed in the gap analysis (section 4.7).

5.2.2 A piling risk assessment will be required at the station and Avon Road Underbridge sites.

SECTION 6

References

Arup. 2016. Metrowest Phase 1, Trackbed Report. Report number W1097B-ARP-REP-ETR-000008, April 2016.

British Standards Institution. 2013. BS 8576:2013 Guidance on investigations for ground gas – permanent gases and Volatile Organic Compounds (VOCs).

CH2M. 2016. Track Ballast Re-Use Outline Risk Assessment, Technical Memorandum (in draft, not issued).

CIRIA. 2001. Contaminated Land Risk Assessment. A Guide to Good Practice (C552).

Department for Environment, Food & Rural Affairs and Environment Agency. 2016. Fresh waters specific pollutants and operational environmental quality standards (EQS). Guidance: Surface water pollution risk assessment for your environmental permit. URL: https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit. Accessed July 2019.

Department for Environment, Food and Rural Affairs. 2014. SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document.

Department for Environment, Food and Rural Affairs. 2012. Environmental Protection Act 1990: Part 2A, Contaminated Land Statutory Guidance.

EIC/AGS/CL:AIRE. 2010. Soil Generic Assessment Criteria for Human Health Risk Assessment.

Environment Agency. 2019. Land contamination: risk management (LCRM). URL: https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks. Accessed July 2019.

Environment Agency. 2015. Technical Guidance WM3 - Waste Classification: Guidance on the classification and assessment of waste. First Edition.

Environment Agency. 2009. Soil Guideline Values for dioxins, furans and dioxin-like PCBs in soil. Science Report SC050021/dioxins SGV.

ICE Publishing. 2012. UK Specification for Ground Investigation. Second Edition.

Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

Structural Soils Ltd. 2016. Factual Report on Ground Investigation at Metrowest. Report no. 730673.

URS. 2014. Trackbed Investigation, Metrowest Phase 1 Interpretative Report. Report no. 4707004/WT/PL/140569/2, April 2014.

Water Framework Directive (2015) (Standards and Classification) Directions (England and Wales).

Water Supply (Water Quality) Regulations 2016.

SECTION 7

Abbreviations

ABS	Automatic Ballast Samples
BH	Borehole
C4SL	Category 4 Screening Levels
CEMP	Construction Environmental Management Plan
CoCP	Code of Construction Practice
CWSC	Controlled Waters Screening Criteria
DCO	Development Consent Order
DWS	Drinking water standards
EA	Environment Agency
EQS	Environmental Quality Standards
ES	Environmental Statement
FDTP	Foundation trial pit
GAC	Generic assessment criteria
L	Leachate
LEL	Lower Explosive Limit
LTEL	Long term exposure limits
mbgl	metres below ground level
MG	made ground
MMG	Mercia Mudstone Group
MOVA	Microprocessor Optimised Vehicle Actuation
NRIL	Network Rail Infrastructure Ltd
NSDC	North Somerset District Council
NSIP	Nationally significant infrastructure project
NR	Not recorded
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
(P)MG	Possible made ground
POS	
RIGS	Regionally Important Geological and Geomorphological Sites
RZ	Response zone
S	Soil
S4UL	Suitable for Use Levels
SGV	Soil guideline value

SOM	soil organic matter
SSSI	Site of Special Scientific Interest
STEL	Short term exposure limits
TFD	Tidal Flat Deposits
UKSGI	United Kingdom Specification for Ground Investigation
VOC	Volatile organic compounds
WAC	Waste acceptance criteria
WM3	

ch2m