Shell UK Oil Products Limited

Shell Solihull Fuel Retail Station

Preliminary (Phase 1) site assessment report

Project no. 252860

RSK GEOSCIENCES

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Author	Sorina Sulitau	**Technical reviewer**	Raymond Watson
Signature		Signature	
Project manager	Raymond Watson	**Quality reviewer**	Jessica Fretwell
Signature		Signature	

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EXECUTIVE SUMMARY

Objective	Shell UK Oil Products Limited (Shell) commissioned RSK Environment Limited (RSK) to carry out a preliminary (Phase 1) site assessment for the operational Shell Solihull fuel retail station at Warwick Road, Solihull, B91 1BB. The objective of the work is to provide information to allow the current environmental status of the site to be assessed, in support of Shell's asset management programme. The site has been assessed on the basis of a continued petroleum retail usage, with the CSM assuming a redeveloped site layout, generally comprising: • an increase in footprint of the retail premises, moving the premises toward the western bounds of the site • removal of the drive-through car wash and associated below ground structures • installation of a jet wash and associated drainage in the southern site corner • Electric Vehicle (EV) charging facilities to be installed along the southern / western bounds of the site, with associated infrastructure
Scope	The scope of works involved a desk-based review of available information, including that from a commercially available environmental database and obtained from a site walkover.
Site description and infrastructure	The site consists of a forecourt area with shop, canopy, jet wash and air/water dispenser. 4 No. fuel dispenser pump islands are located in the centre of the site, linked to 2 No. dual-compartment double walled underground storage tanks (USTs) located east of the pumping stations. There are no known disused tanks on site, since a number of disused tanks were removed during site redevelopment and remediation undertaken in 2016-17.
Site location	The site is generally flat, with a slight slope towards the south. The site is located in a predominantly residential setting with some commercial businesses nearby. Residential dwellings border the site to the north, east, south and west, at distances of between 0m and 20m from the site. The site is separated from the houses located north and west by Warwick Road and Wadleys Road. A dentist office is located approximately 35m north-west of the site and a clinic is also located further east (34m away).
Geology, hydrogeology and hydrology	Geological mapping indicates that the site is underlain by superficial deposits of Till / Diamicton, followed by Glaciofluvial Deposits and bedrock of Sidmouth Mudstone Formation. Due to the developed nature of the site, made ground deposits are likely to be present on site. Previous reports for the site confirmed the geological sequence, with made ground deposits of a proven thickness of 0.90m to 3.20m underlain by sandy clays and gravelly clays representing Till, with a proven thickness of 1.0m to 1.9m. The Till was underlain by sand and gravel representing Glaciofluvial Deposits to the bases of the exploratory holes (maximum 7.0m bgl), with a thickness of 1.4m to 3.7m recorded. The Till superficial geology beneath the site is classified as a Secondary (Undifferentiated) Aquifer. The Glacial Deposits superficial geology beneath the site is classified as a Secondary A Aquifer. The Sidmouth Mudstone Formation bedrock geology beneath the site is classified as a Secondary B Aquifer. The nearest surface water feature is an un-named stream, approximately 340m to the north-east of the site at its nearest point.
Background information	The information available regarding environmental investigations on site dates back to 1998 and 2003, when the presence of constituents of potential concern (COPC) were identified in the vicinity

	of the pump islands. The investigations also identified the presence of disused historic underground storage tanks (UST) at the site. Another site investigation with subsequent groundwater monitoring was undertaken in 2014, which further delineated the extent of COPC, including light non-aqueous phase liquid (LNAPL). Detailed quantitative risk assessment (DQRA) modelling identified potentially significant risks to the controlled waters receptor (Secondary A Aquifer) in groundwater at a 100m compliance point. The site was remediated in 2016-17, which comprised the excavation of areas of unsaturated zone soils from the forecourt area to a depth of 4.50m below ground level (bgl), the removal of all tanks and backfill with type 1 stone. The impacted areas that could not be excavated were treated through in-situ soil injection. Following the remediation, it was considered that residual soil COPC concentrations do not present an unacceptable risk to the aquifer. Whilst post-remedial groundwater monitoring in 2017 indicated limited COPC concentrations remained above site specific assessment criteria (SSAC) for a 100m compliance distance from site, the remedial works were validated to the satisfaction of the Local Authority, with the Town Planning condition associated with the validation of remediation discharged in June 2017. All monitoring wells were decommissioned in 2018, and no further investigations are indicated to have taken place on site.
Site history	The site was developed from a presumed residential use (Holly Cottage) to a garage in 1952. By 1976, an above ground tank and canopy appear on site, which indicates a petrol filling station was present within the garage grounds. The site was redeveloped into a Shell fuel retail station in 1992, which is still active. Risks associated with the potential presence of unexploded ordnance below the site are considered to be medium, though significant post World War II redevelopment has taken place at the site.
Initial conceptual site model (ICSM)	Potentially complete pollutant linkages at the ICSM stage comprised: • retail and non-retail petroleum COPC in soil and groundwater – volatilisation and migration of vapours via permeable strata/service trenches – off-site residential receptors • non-retail petroleum COPC in soil and groundwater – volatilisation and migration of vapours via permeable strata/service trenches – current and future site workers • retail and non-retail petroleum COPC in soil – remobilisation – groundwater beneath the site • retail and non-retail petroleum COPC in groundwater – lateral migration – groundwater within the wider Secondary A aquifer
Data gaps	Data gaps identified from the assessment comprise: • identification of concentrations of non-retail petroleum COPC at the site, associated with a historic garage site usage • identification of current concentrations of COPC in soil • identification of current concentrations of COPC dissolved in groundwater • identification of current soil vapour concentrations • identification of the condition of the site potable water supply.
to The information given in this summary is necessarily incomplete and provided for initial briefing purposes only. The summary must not be used as a substitute for the full text of the report.	

1 INTRODUCTION

1.1 Objectives

Shell UK Oil Products Limited (Shell) commissioned RSK Environment Limited (RSK) to carry out a preliminary (Phase 1) site assessment for the operational Shell Solihull fuel retail station at Warwick Road, Solihull, B91 1BB.

The purpose of the assessment was to provide information to assess the site's current environmental status in support of Shell's asset management programme.

RSK understand that redevelopment of the site is being considered, subject to successful Town Planning approval.

The investigation includes the development of a conceptual site model (CSM). The site has been assessed on the basis of a continued petroleum retail usage, with the CSM assuming a redeveloped future site layout, generally comprising:

- an increase in footprint of the retail premises, moving the premises toward the western bounds of the site
- removal of the drive-through car wash and associated below ground structures
- installation of a jet wash and associated drainage in the southern site corner
- Electric Vehicle (EV) charging facilities to be installed along the southern / western bounds of the site, with associated infrastructure

1.2 Scope

The scope of this assessment has been developed in accordance with relevant British Standards and authoritative technical guidance, as referenced. The assessment of the contamination status of the site is in line with the technical approach presented in Land Contamination Risk Management (LCRM) (Environment Agency (EA), 2021a) – which supersedes CLR11 Model Procedures for Land Contamination – and in general accordance with BS 10175: 2011 + A2 2017 Investigation of potentially contaminated sites – Code of practice.

The scope of works for the assessment included:

- a review of publicly available information for the site and its environmental setting obtained via a commercially available environmental database report (Groundsure)
- a site walkover survey including photographs
- a review of available records including title plans, as-built drawings, wet-stock reconciliation records, site maintenance records and any available historical environmental reports pertaining to the site
- a review of statutory underground service location plans provided by utility companies
- a review of records obtained from the petroleum officer and local authority
- development of a CSM
- preparation of this Phase 1 preliminary site assessment report

1.3 Limitations

This report is subject to the RSK service constraints given in Appendix A and limitations that may be described through this document.

1.4 Sustainability considerations

The concept of sustainability, which can be defined as a capacity to endure, has environmental, economic and social dimensions. As part of RSK's corporate responsibility policy, sustainability considerations were taken into account during the design, planning and implementation stages of the works described in this report. Appendix B sets out these considerations and the RSK approach to sustainability.

2 PRELIMINARY INVESTIGATION

The information in this section is from a review of a range of information sources, comprising:

- a site reconnaissance visit (with site photographs in Appendix C)
- Groundsure environmental database report, including historical mapping (see Appendix D)
- site drawings
- pre-existing environmental site assessment reports
- correspondence with the local authority environmental health department and local licensing authority petroleum officer (see Appendix D)
- an internet search for historical information relating to the site, including the local authority online planning portal
- records of fuel infrastructure at the site
- maintenance records from the site
- fuel wet stock reconciliation records from the site (see Appendix D)
- underground service plans
- geological maps and British Geological Survey (BGS) borehole records
- Environment Agency (EA) online resources

2.1 Site details

Table 1 provides site identification details.

Table 1: Site details

Site name	Shell Solihull
GSAP ID number	10019130
Address	Warwick Road, Solihull, B91 1BB
National Grid reference	413925, 280805
Approximate site area	2800 m^2
Tenure	Freehold

Figure 1 shows the site location. Appendix D includes a land title plan, which represents RSK's understanding of the site's extent.

2.2 Site location, description and features

The site is situated within a predominantly residential and commercial setting within Solihull. A railway line is present approximately 135m west of the site.

The site elevation is approximately 134m above Ordnance Datum (AOD). The site is generally level.

Table 2 summarises the site surroundings.

Table 2: Site surroundings

Feature	Information	Information source(s)
Development to the north	The site is bordered to the northeast by Warwick Road, and to the northwest by Wadleys Road. 2 storey detached residential dwellings with associated soft landscaping and gardens are present beyond Warwick Road, from a distance of 20m from site. An electric substation is present approximately 50m north. The northwestern site boundary with Wadleys Road is formed of mature trees and hedgerow, which are covered by a grouped Tree Preservation Order (TPO).	Site walkover / aerial imaging / Local Authority TPO records
Development to the south	The site borders a 2 storey detached residential dwelling with associated garden to the south of the western site area, separated from the site by a wooden fence. 2 storey detached residential dwellings are present further south. 3 No. TPOs were identified in relation to mature trees situated in close proximity to the southerm site boundary.	Site walkover / aerial imaging / Local Authority TPO records
Development to the west	The site is bordered by Wadleys Road and Fircroft to the west. 2 storey detached residential dwellings with associated soft landscaping and gardens are located at a minimum distance of 20m west of the site. A dentist office is located 35m north-west, across Wadleys Road.	Site walkover / aerial imaging
Development to the east	The site is bordered by a 2 storey detached residential building to the east, separated from the site by a brick wall. Onwards are additional residential dwellings, onto a medical clinic from approximately 30m to the east.	Site walkover / aerial imaging

Figure 2 shows the locations of key features in the site surroundings described above, where relevant.

2.3 Site features

The site was visited on 31st March 2023 to undertake a site walkover. The site features, as they were recorded at the time, are shown on Figure 2.

The site consists of a forecourt area with a shop, canopy, jet wash, car wash and air/water dispenser. The shop is located in the centre-west section of the site, with the jet wash located adjacent to the south, followed by the car wash further south. A vacuum station and an Amazon parcel locker are also present along the southern boundary of the site.

There were 4 No. underground storage tanks (UST) recorded in current operation at the time of the site walkover, situated in the eastern part of the site. No above-ground storage tanks (AST) or liquefied petroleum gas (LPG) tanks were recorded as being present.

4 No. fuel dispenser islands were beneath a single canopy in the centre-east of the site, dispensing unleaded petrol and diesel.

Tank fill points were observed to be above ground and offset from the tanks, located along the eastern site boundary.

Box gullies surround the concrete hardstanding placed in front of the tank fill points. Gullies are also present between the pumping stations.

A single stage interceptor to the south of site serves forecourt drainage and a three-stage interceptor located adjacent east of the jet wash, serving the jet was hand carwash.

Available site records indicate the interceptors discharge to a local foul water sewer. A soakaway is indicated from the service plans to be present in the south-west corner of the site, which is recorded to receive rainwater and surface water from areas of the site without fuel dispensing. During the site-walkover, it was noted that the south-west section of the site is separated from the rest of the site by a brick wall, with a locked wooden gate for access, and dense tree cover beyond. As a result, access could not be gained to inspect the soakaway, or this area in general. Photographs taken above the fence line indicate the south-west corner of the site is overgrown with vegetation.

The forecourt consists of concrete hardstanding across the area of the pump islands, in front of the tank fill point, along the east side of the shop and within the jet-wash area. Tarmacadam hardstanding was observed in all other areas open to vehicle traffic.

The site forecourt was in observed to be in generally good condition, with rare fine cracks noted to some concrete hardstanding. Surface staining was noted around the forecourt fuel-dispensing islands.

Areas of soft landscaping are present along the north, east, south and west borders of the site, with trees and bushes present to the south and along the western border. The area of soft landscaping to the south and south-east of the site is set on a slope towards the site borders. Metal fencing is present in the south-east corner, in the location of the former LPG tank compound. A concrete base is present in the area of the former LPG tank. Access to the former LPG compound is gained via a stepped path through the soft landscaping.

Local Authority tree protection order records indicate one TPO to be present onsite, for a Birch Tree, within the southwestern site area which was inaccessible during the site walkover survey.

2.4 Details of site infrastructure

Table 3 and Table 4 summarise the details of known site infrastructure. Table 3 summarises records relating to above- and below-ground infrastructure, excluding tanks, and Table 4 presents information on underground storage tanks (UST) and above-ground storage tanks (AST).

Table 3: Facilities and infrastructure

Feature	Description and location	Information source(s)
Underground fuel line details	Fuel system pipework was installed in 2016 alongside new USTs at this time. Fuel system pipework constructed of single walled 'UPP' (Universal Petro Pipe), with offset fill pipework constructed of double walled UPP	Site maintenance records
Details of vapour recovery system	Stage 1&2 inspections were conducted in 2020, with both systems recording passes.	Petroleum Officer records/ site maintenance records

Feature	Description and location	Information source(s)
Canopy detail and headroom capacity	Single canopy – recorded to be 4.4 m high	Site walkover
Interceptor type and capacity	Superceptor, concrete and fibreglass walls within access chamber. Access chamber observed to be in visually good condition during site walkover, slight sheen on water.	Site walkover, maintenance records
Car wash interceptor type and capacity	3 stage interceptor, concrete walls within access chambers. Access chamber observed to be in visually good condition during site walkover, slight sheen on water.	Site walkover, maintenance records
Underground utilities, culverts and pipelines	No major culverts or pipelines identified in the site area. A soakaway is indicated to be present in the south-west of the site, however access could not be gained during the site walkover.	Site walkover, site plans
Overhead utilities	No overhead utilities recorded as present on site.	Site walkover

Table 4: Fuel storage tank details

Tank or compartment no.	Tank location (UST/AST)	Double / Single Skin	Capacity (litres)	Status	Current contents	Date installed	Additional information
Tank 1	UST	DW	19400	Operational	V Power Diesel	2016	No access to tank covers during site walkover due to non-standard covers
Tank 2	UST	DW	48500	Operational	Diesel	2016	
Tank 3	UST	DW	19400	Operational	V Power Unleaded	2016	
Tank 4	UST	DW	48500	Operational	Unleaded	2016	
3 No. previously active vessels (5 compartments) and 9 No. historical vessels	UST	N/A	N/A	Decommissioned	N/A	N/A	Concrete filled, / slurry and foam filled removed in 2016
Information sources: Shell engineering database information / records obtained from petroleum officer / site records / previous report information							

Information obtained from site maintenance records indicates that Tank 3 was tested on 12 March 2020. The testing indicated an ullage failure, caused by a release on the 4 bolt gasket located on the tank lid.

2.4.1 Records of disused/historical tanks

As shown in Table 4, the search of historical records relating to the site indicates that 3 No. previously active UST vessels (comprised of 5 compartments in total) were

decommissioned and removed in 2016. The currently operational UST were installed in the same position as the removed tanks.

A further 9 No. historical concrete filled tanks were identified (3 No. in the north-western corner, 3 No. in the north-eastern area of the site, 3 No. in the south-eastern area of the site) and removed, also in 2016 alongside site redevelopment.

It should be noted that records of USTs on petroleum retail sites may be incomplete. Consequently, on some sites, disused USTs may be present that cannot be identified during a preliminary assessment.

Figure 2 presents the site features identified as far as they are known, including the locations of the 9no. historical tanks removed in 2016.

2.4.2 Wet stock management records

RSK was provided with wet stock management information from Fairbanks Environmental Limited, which has managed wet stock reconciliation at the site since 2012. The site is monitored using a system which collects data in real time directly from the electronic tank gauges and the point of sale.

Wetstock reconciliation records within Appendix D indicate a minor release was identified and repaired from Pumps 3/4 in February 2016.

2.5 Site setting

2.5.1 Geological setting

Table 5 summarises published records relating to the site's geological setting.

Table 5: Geological setting

Feature	Information	Estimated thickness (m)	Information source(s)
Recorded geological succession	Made ground: No artificial ground is shown beneath the site on published geological maps. However, made ground is likely to be present near below-ground fuel infrastructure, and has been recorded during previous phases of investigation	0.9 to 3.2, up to 4.5m in areas previously remediated and backfilled	BGS borehole records, BGS geological maps, Environmental database report, Previous reports
	Superficial deposits: Till, Diamicton underlain by Glacifluvial Deposits	1.0 to 1.9 for Till and 1.4 to 3.7 for the Glaciofluvial Deposits	BGS geological maps, BGS Boreholes, Previous Reports
	Bedrock: Sidmouth Mudstone Formation	120 to 130	BGS geological maps

Records from BGS mapping indicate that the site is underlain by superficial deposits of Till, Diamicton, followed by Glaciofluvial Deposits and bedrock of Sidmouth Mudstone Formation. Due to the nature of the site, made ground deposits are likely to be present on site.

Previous reports for the site confirmed the geological sequence, with made ground deposits of a proven thickness of 0.90m to 3.20m underlain by sandy clays and gravelly clays representing Till, with a proven thickness of 1.0m to 1.9m. The Till was underlain by sand and gravel representing Glaciofluvial Deposits to the bases of the exploratory holes (maximum 7.0m below ground level (bgl)), with a thickness of 1.4m to 3.7m. The base of the Glaciofluvial deposits was not proven, and therefore there is no information about the bedrock depth or composition onsite. Information taken from BGS borehole logs in the surrounding area that the Mercia Mudstone is locally present at a depths of approximately 5.5m to 6.5m bgl.

Areas subject to remedial excavation in 2016 are recorded to have been backfilled with imported material to a depth of 4.5m bgl.

BGS boreholes in the surrounding area indicate the presence of silty and clayey sands representing Glacifluvial Deposits, which were proven from the ground level to the bases of the exploratory holes (up to 5.45m bgl). The Glaciofluvial Deposits were identified 482m north-west (SP18SW43), 614m north-east (SP18SW377) and 532m south-east of the site (SP18SW179). Till deposits comprising sandy clay were encountered in BGS boreholes located 708m south-west of the site (SP18SW318), which were underlain by Glaciofluvial Deposits.

BGS boreholes in the proximity of the site and the findings from the previous investigations conducted on site indicate that the clay layer of Till which overlies the sands and gravels of the Glaciofluvial Deposits are only encountered on site and to the south-east of the site. The areas north-west, north-east and south-east of the site, were underlain by Glacial Deposits of sand from ground level.

Hydrogeological setting

Table 6 summarises published records relating to the site's hydrogeological setting.

Table 6: Hydrogeological setting

Feature	Information	Information source(s)
Aquifer designation	The Till superficial geology beneath the site is classified as a Secondary (Undifferentiated) Aquifer, defined by the EA as assigned in cases where it has not been possible to attribute the aquifer unit as either a Secondary A Aquifer (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) or 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). The Glacial Deposits superficial geology beneath the site is classified as a Secondary A Aquifer. The Sidmouth Mudstone Formation bedrock geology beneath the site is classified as a Secondary B Aquifer. Groundwater vulnerability mapping indicates the site is in a medium vulnerability area.	EA website, Environmental database report

Feature	Information	Information source(s)
Depth to groundwater and flow	The anticipated depth to the groundwater table within the Glaciofluvial Deposits is in the order of 3.35m to 4.55m bgl estimated from previous investigations. Shallow groundwater in the site area is anticipated to flow in a north-east direction. The depth of groundwater within the underlying bedrock aquifer has not been proven onsite. If present, any weathered horizon at the surface of the bedrock geology may create a hydraulic separation between groundwater within the superficial and bedrock geologies. The regional direction of groundwater flow is anticipated to be towards the north-east, in line with local topography and toward surface waters.	Previous environmental assessment reports
Groundwater source protection zones	The site is not recorded to be situated within a groundwater source protection zone (SPZ). The nearest SPZ to the site is around 8.0km to the north-west of the site and relates to a Zone I (inner catchment) SPZ, defined as the area representing a 50-day travel time from any point below the water table to the source.	EA groundwater vulnerability map, Environmental database report
Groundwater abstractions	The nearest recorded groundwater abstraction is 1688m to the north-east of the site, used for non-evaporative cooling purposes at the Jaguar Land Rover plant. There are no abstractions used for public potable water supplies recorded within a 2km radius of the site, including within the Local authority Private Water Supply Register	BGS hydrogeology map, Environmental database report, Local Authority records
Anticipated groundwater flow direction	Local groundwater flow is expected to follow topography and flow to the north-east, in the general direction of the nearest recorded surface water receptor – around 340m to the north-east of the site. Previous phases of site assessment, summarised within Section 3 have indicated a general north-easterly flow direction.	Site walkover, previous reports

Hydrological setting

Table 7 summarises published records relating to the site's hydrological setting.

Table 7: Hydrological setting

Feature	Information	Information source(s)
Surface water (hydrology)	The nearest surface water feature is an un-named stream, which emerges approximately 340m to the north-east of the site at its nearest point, within the grounds Olton Golf Course. This area is recorded to be several metres topographically lower than site. Olton Reservoir located 630m north-west. The Grand Union Canal is located at a distance of 1.17km to the north-east of the site, though is likely to be hydraulically separate from the surrounding groundwater body. A pollution event caused by water with suspended solids was recorded 390m north of the site in 2002, which had a minor impact on water.	Environmental database report
Indicative fluvial floodplain	The site is not located within a flood zone. The risk of flooding from surface waters is considered to be negligible on site.	Environmental database report
Site drainage	Forecourt drainage from fuel dispensing areas and car washes appears to be discharged to local foul sewer, via onsite interceptors. Surface water from elsewhere onsite appears to discharge to ground via a soakaway within the southwest of site.	Site records

2.5.3 Other site sensitivities

Table 8 summarises any other sensitivities relevant to the site and surrounding area.

Table 8: Environmentally sensitive areas

Feature	Information	Information source(s)
Sensitive Land Uses	There are considered to be no specifically designated sensitive land uses (e.g. Sites of Special Scientific Interest) within a 500m radius of the site	Environmental database report
Radon	The environmental database report (GroundSure report, 2023) indicates that the site is not within an 'Affected Area' as defined by the Documents of the National Radiological Protection Board (Radon Atlas of England and Wales, NRPB-W26-2002) and therefore the risk of significant ingress of radon into structures on-site is considered low.	Environmental database report
Coal mining affected area/ Cheshire brine subsidence affected area / other areas of	The site is not recorded to be situated within a coal mining affected area or brine subsidence affected area. Historic surface ground workings are recorded at a distance of 80m east of the site and 126m west of the site, associated with a pond and cuttings, respectively.	Environmental database report

Feature	Information	Information source(s)
rock or mineral mining		
Unexploded ordnance (UXO)	According to the Zetica online maps, the site is in an area of moderate risk from unexploded ordnance. However no readily available records indicate that the site was bombed. Historical mapping indicates the area surrounding the site has been intensely developed after the second World War. The several phases of subsequent redevelopment at the site are considered to lower the potential of encountering UXO during any future redevelopment activities.	Zetica Mapping, historic maps

2.6 History of site and surrounding area

Table 9 assesses land-use history and development at the site and surrounding area. This section also summarises the specific history of the site as a retail petroleum site, drawn from the various sources consulted during the Phase 1 assessment.

Table 9: Chronology of activities on and off site

Date/scale	Summary of on-site activity	Summary of off-site activity	Information source(s)
1886 – 1920 1: 2,500 and 1:10,560	The centre of the site is occupied by 'Holly Cottage'	Agricultural fields are present at north, east and south, with a farm 200m south-east and a manor with associated garden and pond to the immediate north-west. A rail line is present 150m west of the site, in the present day (approximately north to south) orientation.	Environmental database report
1937 – 1938 1:2,500 and 1:10,560	The site is still occupied by 'Holly Cottage'	The agricultural fields and manor were redeveloped into residential dwellings and the pond was infilled by 1937. The area to the immediate south-east of the site is a woodland.	
1952 – 1976 1:1,250, 1:2,500 and 1:10,560/10,000	A garage has been constructed in the eastern section of the site. The centre of the site is still labelled as 'Holly Cottage', which is relabelled as 'World's End' by 1955. The building is not labelled from 1959.	The surrounding areas and the woodland to the south-east of the site have been further developed into residential dwellings. A nursery is present approximately 150m east of the site from 1952 to 1968. An electrical substation is present approximately 120m east of the site from 1968. A rail line is present 150m west of the site. An electrical substation appears 50m north of the site by 1954-55.	
1976 – 1992 1:2,500 and 1:10,000	A tank is recorded as present to the east of the garage and a canopy appears along the north-eastern border of the site from 1976.	The building 30m north-east of the site is labelled as a school from 1976 and an electrical substation is labelled 160m south-west of the site, along the western side of the rail line. A school is shown 300m west of the site from 1978.	
1992 – Present 1:2,500 and 1:10,000	The is understood to have been a dedicated fuel filling station from around 1992 to the present day. 2003 mapping indicates the site in a similar arrangement to the present day.	The school 30m north-east to the site becomes a residential dwelling by 2003. No other notable offsite changes are identified.	Environmental database report, aerial mapping, previous environmental assessment reports

In summary, the site was occupied by Holly cottage from 1887, the earliest available map sheet. A structure labelled as a garage was developed in the eastern part of the site from at least 1952-53. From 1976, an above ground tank and a canopy were shown on the mapping. The site is understood to have been a dedicated fuel filling station from around 1992, with the site layout recorded to be generally comparable with the present day alignment from 2003 mapping.

3 PREVIOUS SITE ASSESSMENT WORKS

3.1 Introduction

The section summarises previous site assessment works completed at the site. Table 10 summarises existing site assessment reports and any other relevant documents made available for review.

Table 10: Previous reports and information sources

Title	Company	Report Reference	Date
Petroleum Risk Tier 1 Report	Geo Delft	C1089.SG425.8693	04/09/1998
Petroleum Risk Tier 2 Report	Geo Delft	C1589.SG425.8694	12/03/2003
Geotechnical Investigation	Geo Delft	C1925.SG425	01/09/2004
Preliminary Phase 1 Investigation Report	URS	MARP0001	09/10/2012
Comprehensive Environmental Site Assessment	URS	R46399910-002	07/01/2014
Comprehensive Groundwater and Vapour Monitoring Event	URS	R46399910-004	22/07/2015
Remedial Alternatives Assessment	AECOM	R46399910-005	23/02/2016
Environmental Strategy Plan	AECOM	R60489630-001	03/05/2016
Comprehensive Groundwater and Vapour Monitoring Event	AECOM	GB-10019130-20160630-MON-1	30/06/2016
Environmental Verification Report	AECOM	GB-10019130-20170605-REM-VER	05/06/2017
Comprehensive Groundwater Monitoring Event	AECOM	GB-10019130-20180228-MON-1-CGME	28/02/2018
Well Decommissioning Report	AECOM	GB-10019130-20180613-OTH-1-WDR	13/06/2018

3.2 Summary of previous reports

The findings from the previous reports are summarised in Table 11.

Table 11: Summary of previous reports

Report	Scope of Works	Ground Conditions	Findings
'Petroleum Risk Tier 1 Report', Geo Delft, C1089.SG425.8693, September 1998	Soil gas survey	N/A	A small plume of volatile organic compounds (VOCs) was identified adjacent to the pump islands. VOC concentrations were >100ppm. Disused USTs were identified on site.
'Petroleum Risk Tier 2 Report', Geo Delft, C1589.SG425.8694, March 2003	Intrusive investigation comprising 3 No. shallow boreholes with a soil vapour survey and TPH and PAH laboratory testing.	During the intrusive investigation, granular made ground was encountered over clay followed by sand and gravel. No groundwater was encountered.	The investigation identified 8 No. operational USTs on site, which were reportedly 11 to 15 years old. VOC concentrations >200ppm were identified in the central forecourt, along with maximum soil TPH concentrations of 2010mg/kg in the made ground (mainly Diesel Range Organics), which exceeded Tier 1 screening levels for the site, and several PAH compounds with concentrations exceeding the Tier 1 screening levels for the site. It was concluded that the COPC concentrations encountered did not pose a risk to potential receptors.
'Geotechnical Investigation', Geo Delft, C1925.SG425, September 2004	3 No. boreholes (BH1 to BH3) to 6.0m bgl with associated soil TPH laboratory testing and geotechnical testing	Hardstanding/topsoil over granular made ground to depths between 1.30m and 1.60m bgl. The made ground was underlain by sandy clay to depths between 2.5m and 2.7m bgl (except for BH3, where the layer was not encountered), followed by a layer of sand and gravel encountered from 1.6m – 2.7m bgl to the base of the boreholes. Equilibrium groundwater levels were recorded at 4.25m to 4.52m bgl.	Hydrocarbon staining and odour were encountered in the sand and gravel layer in BH1 and BH3. Hydrocarbon odour was noted from groundwater during purging. Maximum VOC concentrations of 372ppm were encountered in BH3 (located within the central forecourt) at 6.0m bgl. Maximum TPH concentrations of 301mg/kg were encountered in BH2 (adjacent to the car wash in the south-west) at 0.5m bgl. The recorded concentrations did not exceed the generic screening levels used for comparison.

Report	Scope of Works	Ground Conditions	Findings
'Preliminary Phase 1 Investigation Report', URS, MARP0001, October 2012	Preliminary desk study comprising review of historic and current information	N/A	Potential pollutant linkages to human health were identified comprising potentially impacted shallow soils / groundwater followed by: • vapour migration to on-site workers and off-site residents of houses located adjacent to the east and south • particulate inhalation / ingestion / dermal contact with ground workers during redevelopment • permeation through plastic pipes into the site potable water supply. Potential pollutant linkages to controlled waters were identified comprising potentially impacted shallow soils / groundwater followed by: • vertical migration into the superficial aquifers and potentially bedrock aquifers • migration of COPC from soils to perched groundwater and lateral migration to surface water.
'Comprehensive Environmental Site Assessment', URS, R46399910-002, January 2014	Installation of 6 No. groundwater monitoring wells (MW101 to MW106) to up to 6.0m bgl, and 3 No. shallow soil vapour monitoring wells (VP201 to VP203) from 0.55m to 1.0m bgl in November 2012. 3 No. additional soil vapour monitoring wells (VP301 to VP303) were installed in August 2013 in the region of identified light non-aqueous phase liquid (LNAPL). Multiple rounds of groundwater, ground gas and LNAPL monitoring undertaken between November 2012 and September 2013. GPR survey to confirm the location of 6 No. historical concrete filled tanks in May 2013.	Hardstanding/topsoil over granular made ground to proven depths between 0.9m and 1.7m bgl over a layer of gravelly clay to depths between 2.3m and 3.0m bgl. The clay was underlain by sands and gravels to the bases of the boreholes (up to 6.0m bgl). During monitoring, groundwater was encountered at depths between 3.71m and 4.96m bgl, and the groundwater flow direction was inferred to be to east / north-east.	Staining and hydrocarbon odours were noted in the soils of MW101-MW104. Hydrocarbon sheen and odour were noted in the groundwater, and LNAPL was encountered in MW101 (located east of the site, adjacent to historic tanks), MW102 (located adjacent to the historic tanks in the north-east of the site) and BH3 (installed during Geo Delft 2004 investigation, central forecourt), with apparent thicknesses of up to 0.080m, 0.094m and 0.076m, respectively. TPH concentrations of up to 175mg/kg were recorded, in MW106 at 0.5m bgl (located south of the pump islands). Groundwater samples indicated the presence of TPH, PAH and BTEX. The human health assessment indicated that there is sufficient vapour degradation through the unsaturated zone between the groundwater source and the vapour well to mitigate the potential risk to the off-site residents posed by the concentrations observed in the groundwater. No significant risks were simulated to the groundwater in the Secondary A Aquifer from the concentrations of COPCs detected in soil at the site.
'Comprehensive Groundwater and	2 No. groundwater sampling rounds in the existing wells (7 No. groundwater	Average depth to groundwater: 4.19m bgl in November 2014 and	Evidence of the presence of hydrocarbons was recorded from groundwater at MW101, MW102 and MW104.

Report	Scope of Works	Ground Conditions	Findings
Vapour Monitoring Event', URS, R46399910-004, July 2015	monitoring wells and 6 No. soil vapour wells), undertaken in November 2014 and June 2015	4.12m bgl in June 2015. Groundwater was inferred to flow in an easterly (November) to north-easterly (June) direction.	Maximum groundwater COPC concentrations were typically recorded from wells MW101 and MW102. Potential risks to the controlled waters receptor (Secondary A Aquifer) were identified from benzene, naphthalene and aromatic TPH EC5-EC7 in groundwater for a 100m compliance point, selected based on the low exploitation potential of the aquifer locally. The Environment Agency (EA) considered use of a 100m compliance distance, assessed against 95% confidence limits, suitable given the limited thickness of the superficial sand and gravel unit locally, and the lack of local licenced abstractions.
'Remedial Alternatives Assessment', AECOM, R46399910-005, February 2016	Appraisal of suitable remedial options for the site	N/A	A preferred remedial method was inferred to be the excavation of the hotspot along with a 'trap and treat' boundary system in the areas that cannot be excavated.
'Comprehensive Groundwater and Vapour Monitoring Event', AECOM, GB-10019130-20160630-MON-1, June 2016	Groundwater sampling of 6 No. groundwater monitoring wells and 6 No. soil vapour wells in March 2016	Groundwater was encountered at depths between 3.72m and 4.03m bgl.	Hydrocarbon odours and LNAPL were encountered in MW101 and MW102. Maximum groundwater COPC concentrations were typically recorded from well MW102. Potential risks to the controlled waters receptor (Secondary A Aquifer) were identified from benzene and aromatic TPH EC5-EC7 in groundwater for a 100m compliance point.
'Environmental Verification Report', AECOM, GB-10019130-20170605-REM-VER, June 2017	Remedial works comprising delineation investigation drilling, soil excavation and soil injection with associated soil validation sampling. 9 No. historical abandoned USTs were removed, and the existing 3 No. USTs and associated infrastructure were removed and replaced. 2 No. new double skinned USTs with 4 No. compartments, fuel pumps and lines were installed.	The forecourt area and the area north of the shop building (approximately 38m x22m) was excavated to a depth of 4.5m bgl. The excavation was infilled with Type 1 material.	Hydrocarbon impacted material was also identified in some locations which could not be excavated due to the depth and/or the proximity of the site boundary and third party buried utilities. These included areas adjacent to the north, north-eastern and eastern boundary of the site and part of the base of the remedial excavation. These areas were targeted and treated through injection of an in-situ bioremediation scheme. Maximum groundwater COPC concentrations for risk-driving COPC were recorded from well MW206. Limited groundwater COPC concentrations - benzene and aromatic TPH EC5-EC7 in MW201, MW203 and MW206

Report	Scope of Works	Ground Conditions	Findings
	Selected monitoring wells were decommissioned (BH3, MW101 to MW103, VP202 and VP301 to VP303), and 7 No. new groundwater monitoring wells were installed (MW201 to MW207). 4 No. groundwater monitoring events between November 2016 and May 2017.		exceeded the 'stage 3' site specific assessment criteria (SSAC) for a 100m compliance point. Following the remediation, it was considered that residual soil COPC concentrations do not present an unacceptable risk to the aquifer. Whilst groundwater monitoring indicated limited COPC concentrations remained above (SSAC) for a 100m compliance distance, the remedial works were validated to the satisfaction of the Local Authority, with the Town Planning condition associated with the validation of remediation discharged in June 2017.
'Comprehensive Groundwater Monitoring Event', AECOM, GB-10019130-20180228-MON-1-CGME, February 2018	Groundwater monitoring of 10 No. boreholes and groundwater sampling between August 2017 and September 2017, representing the final post-remedial monitoring rounds undertaken at the site, following prior verification of remediation.	Groundwater levels ranged between 4.22m and 4.52m bgl in August 2017 and between 4.25 and 4.56m bgl in September 2017.	Whilst evidence of hydrocarbon COPC was detected in monitoring wells MW201, MW203, MW204, MW206 and MW207, the presence of LNAPL or hydrocarbon sheens were not observed. Groundwater concentrations of benzene and aromatic TPH EC5-EC7 detected in MW201 and MW206 exceeded the derived SSAC for a 100m compliance point for the Secondary A Aquifer, with all other COPC passing. However, concentrations of COPC recorded in groundwater were recorded to have shown significant decreases following remedial activities, with enhanced levels of natural degradation recorded.
'Well Decommissioning Report', AECOM, GB-10019130-20180613-OTH-1-WDR, June 2018	Decommission of 13 No. monitoring wells.	N/A	MW104 to MW106, MW201 to MW207, BH1, VP201 and VP203 were decommissioned. The headworks within MW106, MW203, MW204 and MW207 were retained to maintain the forecourt surface.

4 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) has been produced from the information provided within Section 2 and Section 3.

In order to produce a CSM, sources of constituents of potential concern (COPC), receptors that can be affected and pathways connecting the source and receptor must be identified.

A potential concern exists when a potentially complete pollutant linkage is present, i.e., a possible source and a potential receptor are identified and connected by a plausible pathway. Potential sources, receptors and pathways are described in the sections below.

4.1 Potential sources

4.1.1 Potential on-site primary sources of retail COPC

The following potential primary sources of retail petroleum COPC were identified on site:

Retail petroleum COPC:

- petrol/diesel as light non-aqueous phase liquids (LNAPL) arising from potential losses from fuel storage tanks and fill lines
- petrol/diesel as light non-aqueous phase liquids (LNAPL) arising from potential losses from fuel dispensing infrastructure (underground fuel lines, pump islands)
- potential petroleum hydrocarbon COPC arising from potential losses from surface drainage interceptors and drainage

Figure 2 shows potential primary sources as areas of potential concern.

4.1.2 Potential on-site secondary sources of retail petroleum COPC

The following potential secondary sources of retail petroleum COPC are also considered within the CSM:

- soil impacted with retail petroleum COPC.
- dissolved phase retail petroleum COPC within groundwater.
- soil vapour originating from retail petroleum COPC.

4.1.3 Potential on-site secondary sources of non-retail petroleum COPC

The Phase 1 investigations have identified potential sources of non-retail petroleum COPC associated with historical land uses of the site, comprising:

- garage operating from 1952 to 1992.

4.1.4 Potential off-site sources of retail petroleum and non-retail petroleum COPC

No potentially viable off-site sources of COPC were identified.

Potential off-site current/historical land uses identified near the site not considered to be potential sources comprised:

- potentially infilled ponds located north-west of the site and 80m east, owing to their small size.

- electricity substations 50m north, 120m east and 160m south-west of the site, owing to their distance from the site.
- railway line located 150m west of the site, owing to its distance from the site.

4.2 Potential on-site receptors

The following potential on-site receptors were identified.

Human health:

- workers in the site shop
- site users (including users of potential future EV charging facilities)
- the site's potable water supply

Controlled waters:

- groundwater within the superficial Glaciofluvial Deposits (Secondary A Aquifer) beneath the site

The site is considered in terms of its current land use, i.e., an operational retail filling station.

Outdoor (ambient) air is not considered a receptor, as this is covered by other relevant legislation, for example: Environmental Permitting (England and Wales) Regulations 2010, Part IV of the Environment Act 1995 and Environmental Protection Act 1990 (England, Scotland and Wales) for statutory nuisance.

Customer exposure durations to ambient and indoor air are low, and potential pollutant linkages relating to COPC in the ground beneath the site are considered insignificant.

Construction and maintenance workers, while recognised as potential receptors, for example, during re-tanking excavation works or fuel infrastructure maintenance, are not considered specific receptors in this assessment, as exposure (and other) risks should be controlled through adherence with CDM regulations, method statements and appropriate PPE use.

4.3 Potential off-site receptors

The following potential off-site receptors were identified.

Human health:

- residents in properties located from 0m south and west, and from 20m north and east of the site
- site users of clinic located 34m to the south-east of the site, and dentist office located 35m north-west of the site

Controlled waters:

- groundwater within the wider Secondary A aquifer (Glaciofluvial Deposits) beyond the site boundary
- a surface water stream 340m north-east of the site

4.4 Potential pathways

Human health:

- permeation of plastic pipework
- volatilisation and subsequent vertical and lateral migration of vapours via permeable strata/along backfill to service trenches

Controlled waters:

- leaching from unsaturated zone soils
- remobilisation
- lateral and/or vertical migration

Due to the predominant cover of the site with hardstanding, direct contact exposure pathways (soil and dust ingestion, dermal contact, dust and fibre inhalation, ingestion and dermal contact with LNAPL and dissolved-phase hydrocarbons in groundwater) were not considered for normal operation of the site. Small areas of soft landscaping at sites are likely to comprise imported soil and are too shallow to be affected by below-ground release of COPC. Furthermore, exposure durations to small landscaped areas will be minimal and direct contact exposure linkages are considered incomplete.

4.5 Pollutant linkage risk estimation

Table 12 presents a risk estimation of identified potential pollutant linkages based on current knowledge of possible sources, pathways and receptors relevant to this site. An estimation of risk related to the likelihood of linkages being complete is included in the table. The risk classification has been undertaken in accordance with CIRIA C552 (Rudland et al., 2001), a summary of which is included in Appendix E.

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Table 12: Pollutant linkage risk estimation

Potential source		Possible pathway	Potential receptor(s)		Likelihood	Severity	Risk estimation	Comments	Linkage potentially complete and requiring further evaluation? a
Retail petroleum COPC – onsite, current and historic	Potential COPC in soil and/or groundwater, including from LNAPL if present and methane due to anaerobic degradation of LNAPL	Volatilisation of hydrocarbons and migration into enclosed spaces, e.g., site store, via preferential migration routes such as below-ground pipelines (e.g., sewers), other unsealed service entries and through foundations; explosion, asphyxiation, odours or physiological effects	Human Health - Safety/acute health risk	Current and future site workers/site users	Unlikely	Severe	Low	No known complaints in site store of odours or physiological effects (headaches, nausea, etc.). Risk to site store is low. Site wet stock reconciliation records indicate no evidence of losses likely to cause a risk.	No
	Potential COPC in soil	Permeation of plastic pipework	Human health	Site potable water supply	Unlikely	Medium	Low	Complete linkage dependent on presence of source of COPC within shallow soils around supply pipework, and pipework construction. The most recent available site plans indicate that the site shop potable water supply enters the site via the central western boundary. This recorded route passes in proximity to historic investigation locations BH1 (GeoDelft) and MW104 and VP201 (URS). None of these locations recorded visual or olfactory observations of the presence of retail petroleum COPC within shallow soils. The above observations, allied with the absence of primary fuel infrastructure in proximity to the recorded water supply pipework area indicate, impact to this feature is considered unlikely. COPC were reported at concentrations below the drinking water standards in potable water samples recovered from the shop during the 2014 site investigation report.	No
	Potential COPC in groundwater, including from LNAPL, if present				Unlikely	Medium	Low	Although COPC were identified in the groundwater during the previous investigation, the water supply pipework is expected to be installed above the resting groundwater level of around 4.00-4.50m bgl.	No
	Potential COPC in soil and/or groundwater, including from LNAPL, if present	Volatilisation and migration of vapours via permeable strata/ along backfill to service trenches with subsequent inhalation of vapours	Human health	Current and future site workers	Unlikely	Medium	Low	As a workplace environment, potential indoor and outdoor inhalation exposure to retail petroleum COPC by site workers is controlled under Health & Safety Executive Workplace Exposure Limits (HSE, 2011) to control against short-term and long-term inhalation exposure to chemicals in the workplace. Site operatives are therefore typically considered as receptors with respect to retail petroleum COPC only in terms of immediate safety or acute exposure risks (assessed via a separate line item). Following preceding site investigation works, remediation of the site was undertaken in 2016-2017. Works (described within Section 3) involved removal of historic site fuel infrastructure and a large proportion of unsaturated zone site soils, alongside chemical oxidation treatment to site groundwater. These works will have served to reduce the source mass of COPC onsite. As recorded within the Environmental Verification Report, some concentrations of COPC remained within groundwater and site soils not subject to excavation during the site remediation works. However, the likelihood of pollutant linkages presenting an unacceptable risk to site shop staff was considered unlikely. This was based on concentrations of COPC in unsaturated soil verification samples remaining in-situ, and groundwater collected in May 2017 not exceeding the relevant human health GAC. Potential vapour inhalation risks to site workers are considered lower within the planned future site layout – since the site shop building is indicated to be situated to the west of the current site shop, further away from residual secondary sources of retail petroleum COPC and active fuel infrastructure.	No

Potential source		Possible pathway	Potential receptor(s)		Likelihood	Severity	Risk estimation	Comments	Linkage potentially complete and requiring further evaluation? a
				Current and future site users	Unlikely	Medium	Low	Outdoor (ambient) air is not typically considered a receptor, as this is covered by other relevant legislation, for example: Environmental Permitting (England and Wales) Regulations 2010, Part IV of the Environment Act 1995 and Environmental Protection Act 1990 (England, Scotland and Wales) for statutory nuisance. Notwithstanding the above, customer exposure durations to ambient and indoor air are low during typical expected site usage, including potential future EV charging.	No
				Off-site residential receptors – from 0m south and west, and from 20m north and east of the site	Low likelihood	Medium	Moderate / Low	Vapour intrusion risks associated with retail petroleum COPC have been shown to be negligible for buildings with basements located more than 10 m from the edge of a dissolved-phase hydrocarbon plume (and with >2m vertical separation from the groundwater table), and negligible for buildings without basements (i.e., ground-bearing slab) more than 10 m laterally from residual-phase LNAPL (Lahvis, 2013; USEPA, 2013). Use of the site for fuel retailing pre-dates the ban on the sale of leaded fuels in the UK in 2000. Therefore, lead scavengers ethylene dibromide (EDB or 1,2-Dibromoethane) and ethylene dichloride (EDC or 1,2-Dichloroethane) may be present beneath the site, with the potential to pose inhalation risks to off-site receptors. Previous phases of assessment at the site have not tested for the potential presence of The houses in adjacent areas to the site are considered unlikely to have basements. The likelihood of significant residual LNAPL on site is considered low, however post-remedial monitoring identified the presence of a residual dissolved phase plume, with groundwater flow recorded to the northeast. The anticipated direction of groundwater flow is towards the north-east, thus residential dwellings to the north-east of the site could be impacted. Groundwater levels are anticipated to be 4.00-4.50m bgl in the site area. Given the proximity of the houses to the site, and the potential for EDB and EDC to be present in soil and groundwater beneath the site, it is considered that this potential pollutant linkage warrants further evaluation.	Yes
				Off-site commercial receptors –34m south-east of site and 35m north-west	Unlikely	Medium	Low	The clinic and office are considered unlikely to have basements. The Phase 1 assessment has identified evidence of releases in Tank 3 on site, however the likelihood of significant LNAPL on site or a dissolved phase plume extending beyond the site boundary is considered low. The anticipated direction of groundwater flow is towards the north-east (i.e., not directly towards the clinic or dentist office), with groundwater levels anticipated to be 4.00-4.50m bgl in the site area. Off-site commercial receptors are considered unlikely to be impacted by potential COPC in soil and/or groundwater at the recorded distance from site.	No
Non-retail petroleum COPC – onsite historic	Potential COPC in soil	Permeation of plastic pipework	Human Health	Site potable water supply	Unlikely	Medium	Low	Complete linkage dependent on presence of source of COPC within shallow soils around supply pipework, and pipework construction. The most recent available utility plans for the site indicate that the site shop potable water supply enters the site via the central western boundary, away from the historic location of the 'garage' buildings and infrastructure.	No
	Potential COPC in groundwater, including from LNAPL/DNAPL, if present				Unlikely	Medium	Low	Site water supply pipework is expected to be installed above the recorded resting groundwater level of around 4.00-4.50m bgl.	No
	Potential COPC in soil and/or groundwater,	Volatilisation and migration of vapours via permeable strata/ along backfill to service		Current and future site workers	Low likelihood	Medium	Moderate / Low	Notwithstanding the potential age of any COPC source area and the resultant likely degradation and attenuation, assessment for potential non-retail petroleum COPC associated with historic garage usage of the site was not conducted during previous phases of assessment at the site.	Yes

Potential source		Possible pathway	Potential receptor(s)		Likelihood	Severity	Risk estimation	Comments	Linkage potentially complete and requiring further evaluation? a
	including from LNAPL/DNAPL, if present.	trenches with subsequent inhalation of vapours		Current and future site users	Unlikely	Medium	Low	Notwithstanding the absence of prior testing for the presence of non-retail petroleum COPC associated with historic garage usage of the site, customer exposure durations to ambient and indoor air are low during typical expected site usage, including potential future EV charging.	No
				Off-site residential receptors – from 0m south and west, and from 20m north and east of the site	Low likelihood	Medium	Moderate / Low	Notwithstanding the potential age of any COPC source area and the resultant likely degradation and attenuation, assessment for potential non-retail petroleum COPC associated with historic garage usage of the site was not conducted during previous phases of assessment at the site.	Yes
				Off-site commercial receptors –34m south-east of site and 35m north-west	Unlikely	Medium	Low	The clinic and office are considered unlikely to have basements. The anticipated direction of groundwater flow is towards the north-east (i.e., not directly towards the clinic or dentist office), with groundwater levels anticipated to be 4.00-4.50m bgl in the site area. Off-site commercial receptors are considered unlikely to be impacted by potential COPC in soil and/or groundwater at the recorded distance from site.	No
On-site current and historical sources (retail and non-retail petroleum COPC)	Potential COPC in soil, including LNAPL, if present	Leaching from unsaturated zone soils	Controlled Waters	Groundwater resource within the Glaciofluvial Deposits (Secondary A Aquifer) beneath the site	Unlikely	Medium	Low	Site surfacing comprised mostly of hardstanding which will restrict leaching from unsaturated zone soils. Additionally, a high proportion of unsaturated zone soils were removed and replaced during prior remedial works at the site.	No
		Remobilisation			Low likelihood	Medium	Moderate / Low	Fluctuations in shallow groundwater within superficial deposits may occur, potentially remobilising any residual COPC recorded within site soils not subject to excavation or remedial treatment in 2016-17.	Yes
	Potential COPC in groundwater, including continued dissolution from LNAPL, if present	Migration (lateral migration)		Groundwater resource within the Glaciofluvial Deposits (Secondary A Aquifer) wider aquifer	Likely	Medium	Moderate	Notwithstanding the fact that remedial works were validated to the satisfaction of the Local Authority in 2017, COPC were identified in the groundwater underlying the site during the previous investigations, including limited exceedances of target concentrations at a 100m compliance distance from site during the most recent post-remedial monitoring conducted in 2017.	Yes
				A surface water stream 340m north-east of the site	Unlikely	Medium	Low	Whilst the nearest surface water stream to the site is recorded to be in the direction of groundwater flow (northeast), concentrations of COPC within groundwater would be expected to degrade and attenuate to below target concentrations within the intervening distance, posing an acceptable level of risk	No

Notes:

Indications of likelihood and severity of linkages, together with resultant risk assessment based upon risk assessment methodology included as Appendix E.

The following potentially complete pollutant linkages were identified with a moderate/ low risk or higher:

- retail and non-retail petroleum COPC in soil and groundwater – volatilisation and migration of vapours via permeable strata/service trenches – off-site residential receptors
- non-retail petroleum COPC in soil and groundwater – volatilisation and migration of vapours via permeable strata/service trenches – current and future site workers
- retail and non-retail petroleum COPC in soil – remobilisation – groundwater beneath the site
- retail and non-retail petroleum COPC in groundwater – lateral migration – groundwater within the wider Secondary A aquifer

4.6 Potential data gaps

The following data gaps or areas of uncertainty have been identified from the assessment:

- identification of concentrations of non-retail petroleum COPC at the site, associated with a historic garage site usage
- identification of current concentrations of COPC in soil
- identification of current concentrations of COPC dissolved in groundwater
- identification of current soil vapour concentrations
- identification of the condition of the site potable water supply.

5 CONSTITUENTS OF POTENTIAL CONCERN

5.1 Retail petroleum constituents of potential concern

Petroleum-based fuels comprise many individual hydrocarbon constituents, and it is not possible (or necessarily required) to analyse and assess them all. Constituents of potential concern (COPC) for different fuel types can pose varying risks depending on their mass fraction in the fuel, volatility, mobility, persistence and toxicity.

COPC are specific to certain receptors (e.g., human health or controlled waters) and exposure pathways (inhalation, direct contact exposure or migration in groundwater). COPCs are therefore site specific and dependent on the fuel stored on site, which are known or suspected to have been released, and the different types of receptors potentially affected by a release at a site. COPC are therefore referred to as risk drivers and there is a technical justification for concentrating the analysis and assessment on these key constituents. This approach, as outlined in the 2017 CL:AIRE guidance document “Petroleum Hydrocarbons in Groundwater”, is supported by the Environment Agency.

Based on the potentially complete pollutant linkages summarised in Table 13, the COPC identified as possibly being associated with the site’s current and historical use for petroleum retail purposes (and considered as risk drivers) are highlighted in grey in Table 13.

When the potential for a source of COPC is unknown, it may be necessary to conduct a screening analysis during any phase of investigation or assessment. It may be appropriate to revise and reduce the list of COPC based on future site knowledge and for risk assessment purposes.

Table 13: Identified retail petroleum COPC

Potential exposure pathway	Potential sources of COPC				
	Petrol	Diesel	Kerosene	Liquid propane gas	AdBlue
Indoor inhalation	BTEX[a] Naphthalene n-hexane Fuel ether oxygenates[b] Lead scavengers[c]	Benzene, xylenes Naphthalene TPH Aro band >EC10–EC12 TPH Aliph band >EC8–EC10	BTEX[a] Naphthalene TPH Aro band >EC10–EC12 TPH Aliph bands >EC5–EC6, >EC6–EC8, >EC8–EC10, >EC10–EC12	TPH Aliph band >EC4–EC5	Ammonia
Soil ingestion, dermal contact, outdoor inhalation of vapour and particles	Benzene, toluene Fuel ether oxygenates[b] Lead scavengers[c]	Benzene 2-Methylnaphthalene Benzo(a)pyrene TPH Aro bands >EC10–12, >EC12–16, >EC12–16	Benzene 2-Methylnaphthalene TPH Aro bands >EC10–12, >EC12–16 TPH Aliph bands >EC8–EC10, >EC10–EC12, >EC12–EC16	TPH Aliph band >EC4–EC5	N/A
Groundwater, including ingestion pathways (e.g., impacts to potable water abstractions) and soil leaching to groundwater pathways	BTEX[a,d] ([e] except xylenes) Naphthalene[d] n-hexane[d] Fuel ether oxygenates[b,d] Lead scavengers[c,d] TPHCWG[e]	BTEX[a, d] ([e] except xylenes) TPHCWG[d, e] 2-Methylnaphthalene[d]	BTEX[a, d] ([e] except xylenes) TPHCWG[d, e] 2-Methylnaphthalene[d]	N/A	Ammoniacal nitrogen as NH4 Nitrate Nitrite Total organic nitrogen
Hydrocarbon migration into potable water supply pipes	BTEX, MTBE[f] TPH bands >EC5–EC10, >EC10–EC16, >EC16–EC40[f]			N/A	N/A

Notes:

[a]BTEX, the collective acronym for benzene, toluene, ethylbenzene and xylenes

[b]Fuel ether oxygenates: methyl tertiary butyl ether (MTBE), tetra-amyl methyl ether (TAME), ethyl tertiary butyl ether (ETBE), di-isopropyl ether (DIPE), tertiary-butyl alcohol (TBA)

Potential exposure pathway	Potential sources of COPC				
	Petrol	Diesel	Kerosene	Liquid propane gas	AdBlue
[c]Lead scavengers are associated with *leaded* petrol: 1,2-dichloroethane (ethylene dichloride - EDC) and 1,2-dibromooethane (ethylene dibromide - EDB). May be valid COPC on sites where leaded fuels previously used					
[d]Substance listed as "Recommended petroleum hydrocarbon COPC" or "Other substances of potential concern" CL:AIRE 2017 – "Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies"					
[e]For groundwater pathways - classified as a hazardous substance by the UK Joint Agencies Groundwater Directive Advisory Group (JAGDAG), of which the Environment Agency is a member. The JAGDAG list of hazardous substances was published in January 2017					
[f]In accordance with Water UK guidance (2014)					

5.2 Non-retail petroleum constituents of potential concern

In addition to the COPC identified within Table 14, the Phase 1 investigation has identified potential sources of non-retail petroleum COPC:

Onsite:

- Historical garage

A service garage is recorded to have been in operation at the site between c.1952 – 1992. Garage activities undertaken at this time are likely to have been largely similar in nature to the current retail petroleum site usage, however garages may have used degreasing agents, a potential source of volatile organic compounds (VOCs).

Potential non-retail petroleum COPC associated with the garage are detailed in Table 14.

Table 14: Identified non-retail petroleum COPC

Potential source	Potential pathways	Potential COPC
On site: Motor vehicle repair/ service garage	Inhalation and accumulation of vapours	Volatile organic compounds (VOC) Including VOC risk-driving compounds: Carbon tetrachloride Dichloromethane 1,1,1-Trichloroethane Dichloroethene Trichloroethene Tetrachloroethene Vinyl chloride
	Remobilisation to groundwater and lateral migration	

While unlikely to pose a risk to identified receptors in the current site use scenario, asbestos and heavy metals may also be considered COPC associated with general historical redevelopment of the site. These COPC may be relevant for informing potential waste soil assessments and/or risk assessments for health and safety management of construction and maintenance workers.

6 CONCLUSIONS

The Phase 1 preliminary site assessment has identified several potentially complete pollutant linkages, comprising:

- retail and non-retail petroleum COPC in soil and groundwater – volatilisation and migration of vapours via permeable strata/service trenches – off-site residential receptors
- non-retail petroleum COPC in soil and groundwater – volatilisation and migration of vapours via permeable strata/service trenches – current and future site workers
- retail and non-retail petroleum COPC in soil – remobilisation – groundwater beneath the site
- retail and non-retail petroleum COPC in groundwater – lateral migration – groundwater within the wider Secondary A aquifer

The following data gaps have been identified from the assessment:

- identification of concentrations of non-retail petroleum COPC at the site, associated with a historic garage site usage
- identification of current concentrations of COPC in soil
- identification of current concentrations of COPC dissolved in groundwater
- identification of current soil vapour concentrations
- identification of the condition of the site potable water supply.

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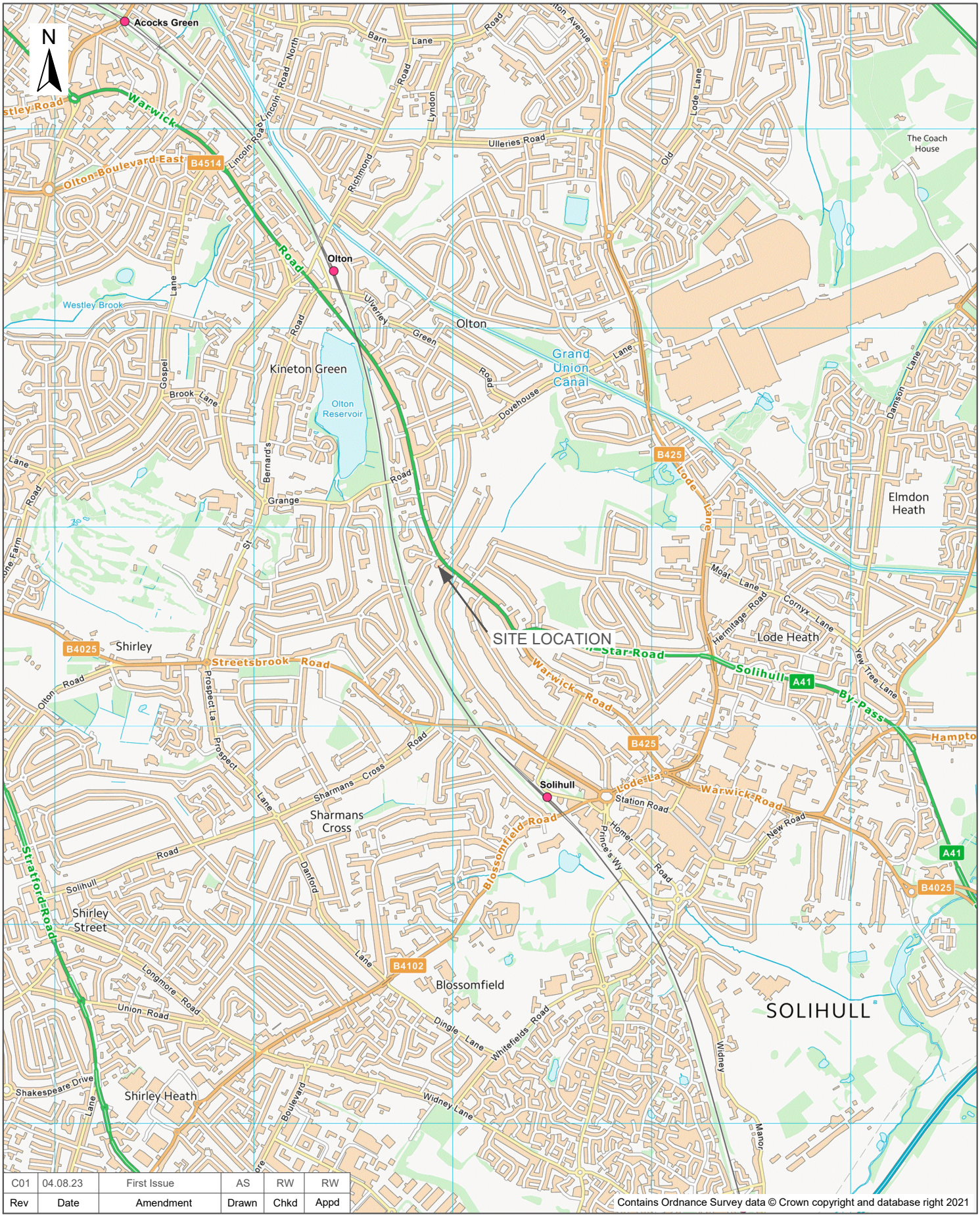
FIGURES



Rev	Date	Amendment	Drawn	Chkd	Appd
C01	04.08.23	First Issue	AS	RW	RW

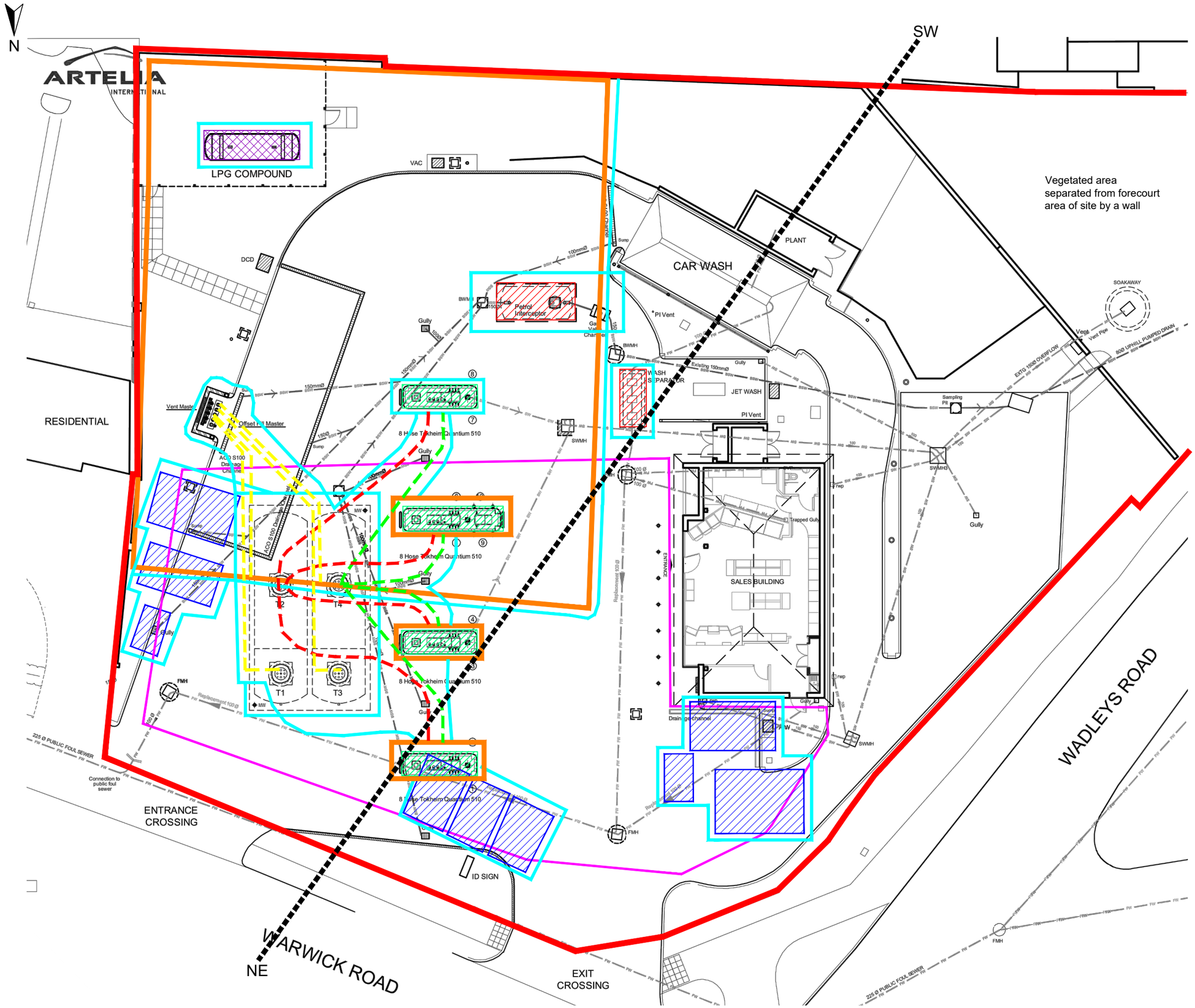
RSK GEOSCIENCES
Abbey Park
Humber Road
Coventry
CV3 4AQ
Tel: +44(0)2476 505600
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client: Shell UK Oil Products Limited

Project Name: Shell Solihull

Description: Site Location Plan

Dimension	Size	Scale	Geolocation	Project ID	Drawing no.	Rev	File name
m	A4	1:25,000	413925, 280803	252860	252860	C01	252860-CV-111-SS-D-C-11101-C01



LEGEND

- Site boundary
- Historic tanks removed in 2016/2017
- Extent of excavated area during remediation in 2016/2017
- Approximate extent of historic garage
- Fuel lines
- Interceptor
- Fuel pumps
- LPG tank removed in 2015 removed from drawing
- Area of potential concern
- Line of section for CSM figure

Rev	Date	Amendment	Drawn	Chkd	Appd
C01	04.08.23	First Issue	AS	RW	RW

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Abbey Park
Humber Road
Coventry
CV3 4AQ
Tel: +44(0)2476 505600
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client
Shell UK Oil Products Limited

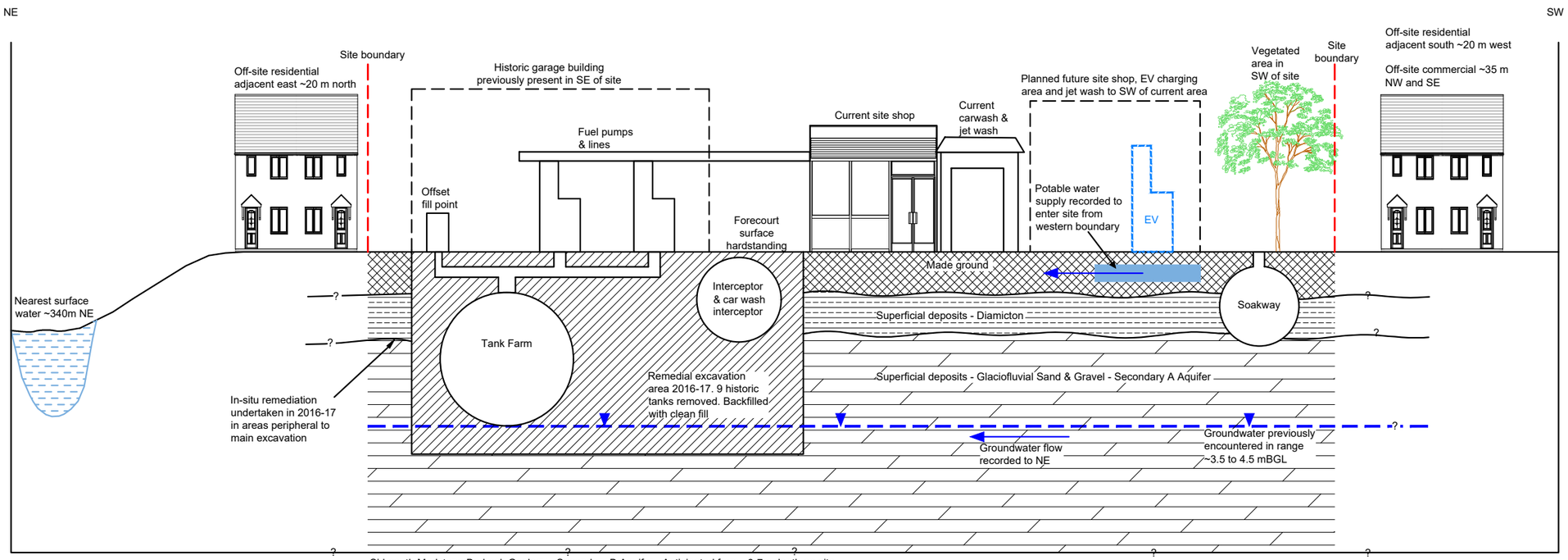
Project Name
Shell Solihull

Description
Site Features Plan

Project ID	Drawing no.	Revision
252860	12101	C01

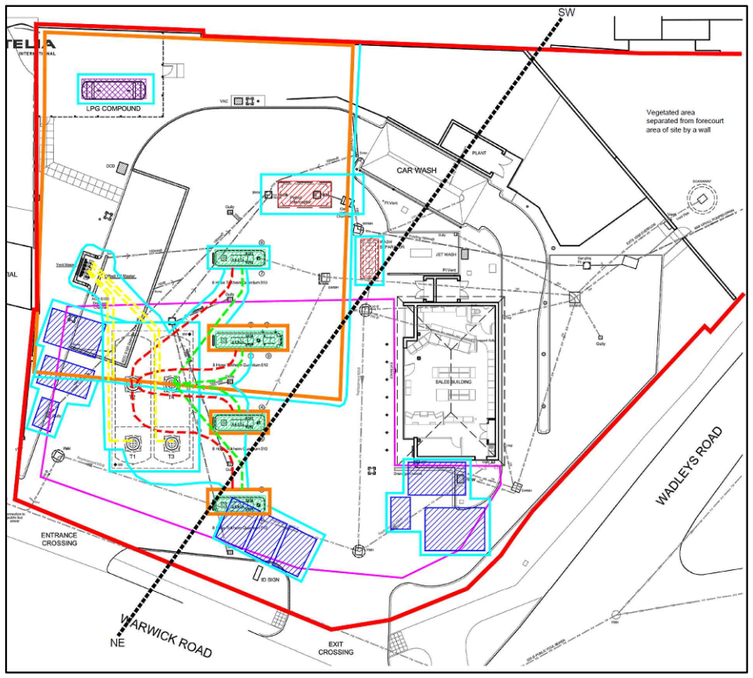
File name
252860-CV-121-SS-D-C-12101-C01

Dimensions	Scale	Size
m	NTS	A3



Plan View

NTS



Potential Sources	Potential Pathways	Potential Receptors
• Petrol/diesel as light non-aqueous phase liquids (LNAPL) arising from potential losses from fuel storage tanks and fill • Petrol/diesel as LNAPL arising from potential losses from dispensing infrastructure (underground fuel lines, pump • Petroleum hydrocarbon COPC arising from potential losses from surface drainage interceptors and drainage. • Soil impacted with retail petroleum COPC. • Dissolved phase retail petroleum COPC within groundwater. • Soil vapour originating from retail petroleum COPC. • Potential non-retail petroleum COPC arising from historical	• Permeation of plastic pipework. • Volatilisation and subsequent vertical and lateral migration of vapours via permeable strata / along backfill to service trenches. • Leaching from unsaturated zone soils. • Remobilisation. • Lateral and/or vertical migration.	• Workers in the site shop. • Site users (including users of potential future EV charging facilities). • The site's potable water supply. • Groundwater within the superficial Glaciofluvial Deposits (Secondary A Aquifer) beneath the site. • Residents in properties located from 0m south and west, and from 20m north and east of the site. • Site users of clinic located 34m to the south-east of the site, and dentist office located 35m north-west of the site. • Groundwater within the wider Secondary A aquifer (Glaciofluvial Deposits) beyond the site boundary. • A surface water stream 340m north-east of the site.
Potentially Complete Pollutant Linkages identified Within Conceptual Site Model		
• Retail and non-retail petroleum COPC in soil and groundwater – volatilisation and migration of vapours via permeable strata/service trenches – off-site residential receptors. • Non-retail petroleum COPC in soil and groundwater – volatilisation and migration of vapours via permeable strata/service trenches – current and future site workers. • Retail and non-retail petroleum COPC in soil – remobilisation – groundwater beneath the site. • Retail and non-retail petroleum COPC in groundwater – lateral migration – groundwater within wider aquifer.		

LEGEND

Rev	Date	Amendment	Drawn	Chkd	Appd
C01	04.08.23	First Issue	AS	RW	RW

RSK GEOSCIENCES
Abbey Park
Humber Road
Convetry
CV3 4AQ
Tel: +44(0)2476 505600
Email: info@rsk.co.uk
Web: www.rsk.co.uk

Client: Shell UK Oil Products Limited

Project Name: Shell Solihull

Description: Conceptual Site Model

Project ID	Drawing no.	Revision
252860	15101	C01

File name: 252860-CV-151-SS-D-C-15101-C01

Dimensions	Scale	Size
m	NTS	A3

APPENDIX A
SERVICE CONSTRAINTS

1 This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK Environment Limited (RSK) for Shell UK Oil Products Ltd (the "Client") in accordance with the terms of a contract dated October 2020 between RSK and the Client. The Services were performed by RSK with the reasonable skill and care ordinarily exercised by an environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the Client.

2. Other than that, expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the Client. RSK is not aware of any interest of or reliance by any party other than the Client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the Client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the Client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas, persistent, bioaccumulative or toxic chemicals (including PFAS and related compounds) or other radioactive or hazardous materials, unless specifically identified in the Services.

7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a visual inspection of the site together with RSK's interpretation of information, including documentation, obtained from third parties and from the Client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

a. The Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely.

b. The Services were limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the visual inspection.

c. The Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the Client and RSK.

8. The intrusive environmental site investigation aspects of the Services are a limited sampling of the site at pre-determined locations based on the known historic / operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters (as stipulated in the scope between the client and RSK, based on an understanding of the available operational and historical information) and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.
10. The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows, may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.
11. Asbestos is often observed to be present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of brownfield and demolition sites indicates that asbestos fibres may be present more widely in soils and aggregates, which could be encountered during more extensive ground works.
12. Unless stated otherwise, only preliminary geotechnical recommendations are presented in this report and these should be verified in a Geotechnical Design Report, once proposed construction and structural design proposals are confirmed.

APPENDIX B
SUSTAINABILITY CONSIDERATIONS

APPENDIX B
GENERIC SUSTAINABILITY CONSIDERATIONS

APPROACH TO SUSTAINABILITY FOR PHASE 1, PHASE 2 AND RISK ASSESSMENT PROJECTS

Sustainability is inherent within RSK's business culture and daily operations through ISO14001. RSK has staff at over 100 locations globally. RSK strives to find innovative and more sustainable methods of working. For example, local offices are utilised where project work and staff competencies allow, deliverables are issued electronically, low-flow sampling is used to reduce waste water.

RSK's operates according to 9 key principles. These are:

1. Hiring, retaining and rewarding talented and dedicated people
2. Building enduring client relationships
3. Encouraging continuous improvement and innovation
4. Promoting a learning culture in a positive working environment
5. Marking strategic investments for sustainable growth
6. Committing to strong, predictable financial performance
7. Maintaining unwavering commitment to health and safety
8. Promoting the concept of sustainability in all that we do
9. Encouraging staff consultation and clear communication

The principle that specifically relates to sustainability is to '***promote the concept of sustainability in all that we do***' although social, economic and environmental considerations are relevant to each of the 9 principles above. Based on these principles and the United Nations Sustainable Development Goals we have built our Corporate Responsibility and Sustainability Route Map around five sustainability pillars to form a holistic approach to our business sustainability strategy.

An example from each of the five sustainability pillars (safety, health and quality (SHEQ), our people and ethics, environment and communities, clients and suppliers, financial and governance) is overleaf. RSK's route map can be found in its entirety on the RSK website.

We are committed to reviewing progress made towards our sustainability targets and goals by publishing a Route Map Annual Report to demonstrate we are addressing the global sustainability challenge.

Individual offices have a nominated CR representative who works with the office manager to implement energy saving practices where possible. RSK has also selected a UK wide supplier of electricity which uses renewable sources (where RSK has control of the electricity supply contract) and implemented vehicle charge points.

Sustainability pillar	Sub topic	Corporate responsibility targets				Our Goal
Financial year		2019	2020	2021	2022	
Safety, health and quality (SHEQ),	Safety:	100% of all workers covered by the SHEQ management system (MS)	All RSK staff trained in Golden Safety Rules	Driver and vehicle management training for all business drivers	100% of worker have completed behavioural safety training module	Collective commitment to getting safety right UNSDG 17
Our people and ethics,	Inclusivity	Gender pay gap reported publicly	Equality and inclusivity training module rollout	80% retention rate of employees returning to work after parental leave	Develop and roll out agile working policy	Be a fully inclusive employer UNSDG 10 & 5
Environment and communities,	Resource efficiency and waste	Establish innovative waste management centre in southern Iraq	Report water use for all offices and implement an action plan for reducing water use	RSK-wide green travel plan	50% of waste diverted from landfill across all operations	Produce less waste and promote the circular economy in all we do UNSDG 11, 12, 13
Clients and suppliers,	Relationship management	Engagement strategy developed for business-critical suppliers	60% of business is repeat business	90% of invoices paid within agreed terms (clients and suppliers)	70% of business is repeat business	All our business relationships to be mutually beneficial UNSDG 8, 9, 17
Financial and governance	Business probity	Business critical documents associated with ethics and compliance available on the intranet	Training about anti-corruption policies and procedures for all staff	Update audit protocol for corporate compliance issues	Update risk assessment process for 3 countries where clients are looking to procure our services	Exemplary professional integrity at all times UNSDG 8, 16

SUSTAINABILITY FOR SHELL PROJECTS

Sustainability is implemented in Shell projects by RSK already using the methods mentioned earlier. Specifically for Shell, sustainability is incorporated at various stages of the E2E plans. At project commencement sustainability and risk-based decision making are linked to the business objectives. Once investigation work is required, best management practices (BMPs) are identified and reported (termed Tier 0).

Tier 0 – Best Management Practices

Where feasible, many BMPs such as those listed below and presented in the accompanying table are already utilised on the majority of projects in accordance with the RSK principles above, where technically appropriate for the specific project. RSK has identified a list of BMPs with methods of measurement and reporting that can be used as a checklist during desk-based and site investigation work. For each investigation undertaken one or two of these can be selected, the rationale for its selection reported and performance against the BMP reviewed. For example, if a BMP of using local resource and local subcontractors is selected a review could be undertaken against the distance driven to and from site each month. A full list of BMPs relevant to general work and, phase 1 and 2 investigations are presented in the accompanying table in this appendix.

Example BMPs for office and site investigation

BMP	Benefit / Impact			Measurement	UN SDG
	Social	Economic	Environment		
Use local resource	People away from home less	Generates local employment Less travel costs	Reduced emissions	Mileage by staff and subcontractors	4.4, 8.1, 8.4, 8.8, 11.6, 12.4
RSK site personnel are trained to operate effectively and safely	Investment in staff, reduce accidents	Reduced liability, reduced sick days	Reduced emissions	Training records, Annual PDR	3.6, 3.9, 4.4, 4.7, 8.3, 8.8, 12.4, 12.6
Maintain vehicles	Reduce accidents	More fuel efficient, reduced repair costs	Reduced emissions	Vehicle maintenance checklist	11.6, 13.2
Conference calls	Less face to face time for building relationships	Reduced travel costs	Reduced emissions	Reason for travel	3.6, 5.5, 5.B, 8.2, 11.6, 12.6
Use low-flow sampling techniques	Truer reflection of dissolved phase impact and thus more certainty in decision making	Reduced waste disposal costs	Reduced waste production	Sampling methodology employed on projects	9.4, 6.3, 12.5
Use onsite testing kits	Time saving and thus faster decision making	Reduced laboratory costs where onsite testing is cheaper	Reduced waste owing to fewer samples analysed	Percentage of onsite testing versus laboratory	12.5
Use a slug for permeability testing	NA	Reduced waste disposal costs	Reduced potential for waste water spillage	Qualitative statement	12.5

Best Management Practice	*Possible* benefit(s) arising			BMP selection rationale	BMP measurement		UN Sustainability Goals
	Environment	Social	Economic		Metric	Evidence	
1. Generic BMPs							
Work safely, be responsible and report positive interventions and incidents	✓	✓	✓	Up to date training to ensure quality fieldwork	Safety training, NMPI reporting	Engineer training dated March 2023, 1 No. NMPI reported	3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents. 3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination. 8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment
Establish electronic networks for data transfers and deliverables, team decisions, and document preparation	✓	✓	✓	Aiming to reduce paper use	Document train	Desk Study Report and third party records delivered online	8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management 12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
Project and stakeholder policies support a healthy work-life balance		✓		Ensure equal opportunities and less stress in the workplace	Policies	Qualitative statement	10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status 10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard 10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality 4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development 5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate
Project and Stakeholder policies discourage unhealthy behavior in the workforce such as smoking or inactive stress management.		✓	✓	Promote a healthy lifestyle and better overall quality of work	Policies	Training records, qualitative statement	3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol. 3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents. 4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development 3.A Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate.
Consideration of stress in the project and workplace and people's ability to perform the task physically and mentally		✓		Promote a healthy lifestyle and better overall quality of work	Project management plan	Qualitative statement	3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment
BMPs - Investigation and Monitoring							
Avoid multiple mobilisations	✓	✓	✓	Lower CO2 emissions due to a reduced number of journeys	Work plan	Qualitative statement	7.3 By 2030, double the global rate of improvement in energy efficiency 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
Minimize vehicle miles - combine jobs where possible	✓	✓	✓	Lower CO2 emissions due to a reduced number of journeys	Work plan	Qualitative statement	7.3 By 2030, double the global rate of improvement in energy efficiency 11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
Consider the use of rechargeable batteries for field instruments versus disposable batteries	✓			Measureable battery levels and greater efficiency		Qualitative statement	12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
Sequence work and traffic patterns to minimize local traffic congestion		✓		Reduce the potential for idling traffic on a petrol station	Traffic management plan	Traffic management plan	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
Select Equipment suitably sized to perform the work	✓	✓	✓	Fieldworks are more efficient and a smaller work area is achieveable for optimum traffic flow	HASP	HASP	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
Consider local sources of field labor	✓	✓	✓	Lower CO2 emissions due to a reduced mileage	Work plan	PO's	10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard
Consider local sources of field equipment	✓	✓	✓	Lower CO2 emissions as less distance travelled to hire/purchase equipment	Work plan	PO's	13.2 Integrate climate change measures into national policies, strategies and planning

APPENDIX C
PHOTOGRAPHIC RECORDS

Photographic Site Overview Plan

A Site entrance, showing residential property to east

B View of the shop

C View of the east site boundary

Site Overview Plan N

D View of pumps and car wash to the south

H View of forecourt facing north

E View of the north site boundary

G View of south site boundary

F View from site exit

PHOTOGRAPHIC LOG

Photo no. **1**	**Date:** 31-03-2023	
Direction photo taken: North-east		
Description: Area to rear of site shop, site western boundary		

Photo No. **2**	**Date:** 31-03-2023	
Direction photo taken: West		
Description: Area to rear of car wash, along south/west site boundary		

PHOTOGRAPHIC LOG

Photo no. **3**	**Date:** 31-03-2023	
Direction photo taken: South		
Description: Concrete base in former LPG tank farm		

Photo No. **4**	**Date:** 31-03-2023	
Direction photo taken: South-west		
Description: Inaccessible area in the south-west corner of the site (photo taken over separating wall)		

PHOTOGRAPHIC LOG

Photo no. **5**	**Date:** 31-03-2023	
Direction photo taken: North		
Description: Forecourt pump island condition – pumps 7/8.		

Photo No. **6**	**Date:** 31-03-2023	
Direction photo taken: East		
Description: Offset fill point		

PHOTOGRAPHIC LOG

Photo no. **7**	**Date:** 31-03-2023
Direction photo taken: N/A	
Description: Forecourt interrceptor	

Photo No. **8**	**Date:** 31-03-2023
Direction photo taken: N/A	
Description: Car wash interceptor – chamber 1	

PHOTOGRAPHIC LOG

Photo no. **9**	**Date:** 31-03-2023	
Direction photo taken: N/A		
Description: Car wash interceptor – chamber 2		

Photo No. **10**	**Date:** 31-03-2023	
Direction photo taken: N/A		
Description: Car wash interceptor – chamber 3		