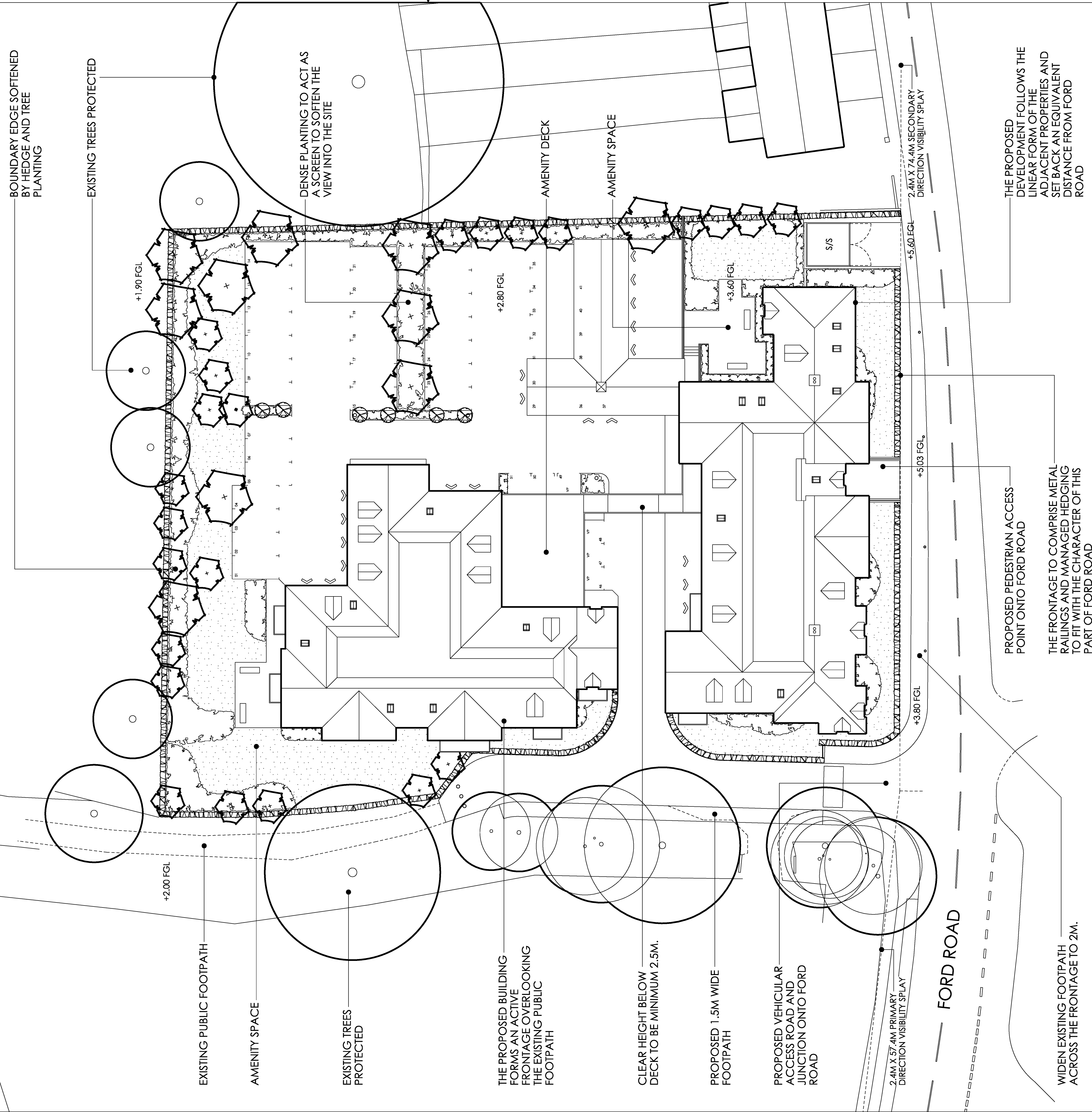


RIVER ARUN



	A1
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RESIDENTIAL DEVELOPMENT SITE PLAN SHOWING

FORD ROAD
ARINDEI

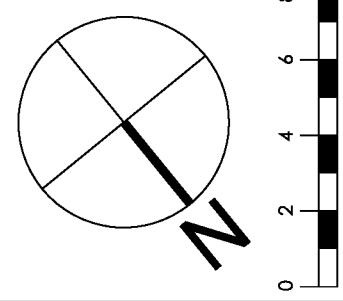
ROOF PLAN

FOR OAKFORD HOMES

SCALE @ A1 1:200	DATE APRIL 2019	AUTHOR AC	CHECK DP	DRAWING NO. PP1249/101-04	REVISION P8
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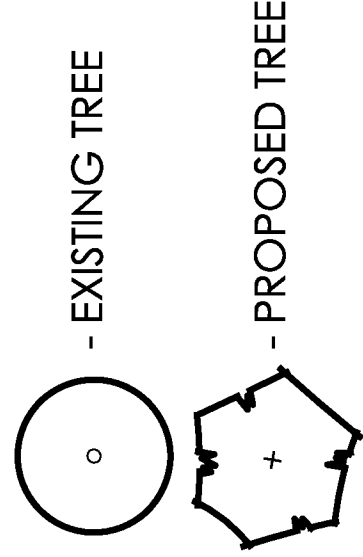
PRELIMINARY ISSUE



A circular field is shown with a north arrow pointing towards the bottom right. A scale bar is provided next to the field, indicating distances of 0, 2, 4, 6, and 8 meters.

FGL - FINISHED GROUND LEVEL

S/S - 4.5m² SQUARE 1.8m HIGH
CLOSE BOARDED ENCLOSURE
TO ELECTRIC SUBSTATION

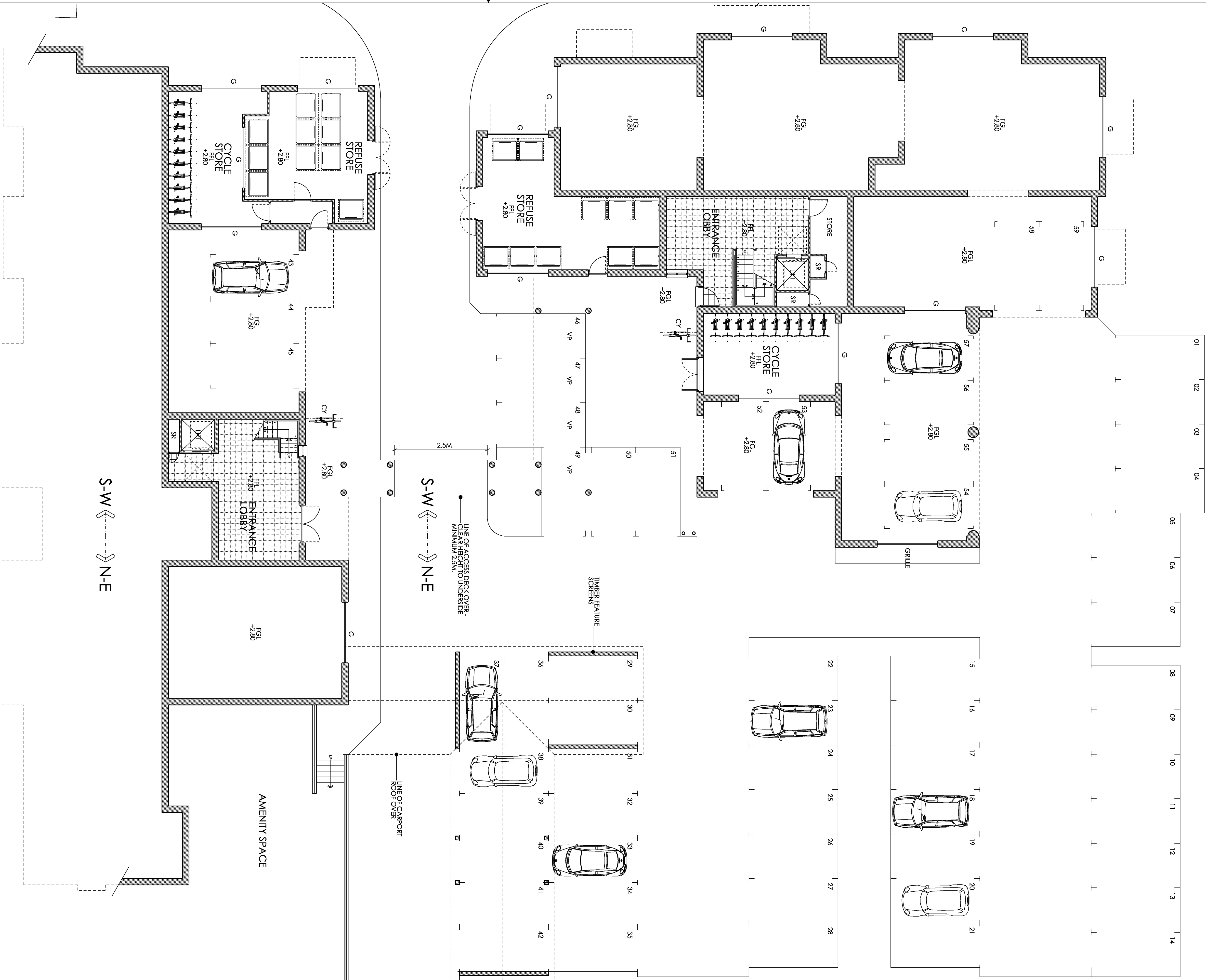


- PROPOSED SHRUB PLANTING
- PROPOSED HEDGING
- UNDERCROFT PARKING

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LOWER GROUND FLOOR PLANS

OUTLINE OF EXTERNAL WALL
AT UPPER GROUND FLOOR



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UNIT 13, VICTORIA LANE, BIRMINGHAM B2 4JQ, ENGLAND. TEL: 0121 633 1000. WWW.POPPRIESTLEY.COM

RESIDENTIAL DEVELOPMENT

FOR OAKFORD HOMES

PP1249/110-01

P5

DATE: FEB 2019

ARCH: AC

CHECK: DP

DESIGNED BY: PP1249/110-01

REVISION: P5

SCALE: 1:100

DATE: FEB 2019

ARCH: AC

CHECK: DP

DESIGNED BY: PP1249/110-01

REVISION: P5

PRELIMINARY ISSUE

VP - VISITOR PARKING

G - GRILLED OPENINGS

FGL - FINISHED GROUND LEVEL

FLL - FINISHED FLOOR LEVEL

CY - VISITOR CYCLE STAND

OUTLINE OF EXTERNAL WALL
AT UPPER GROUND FLOOR

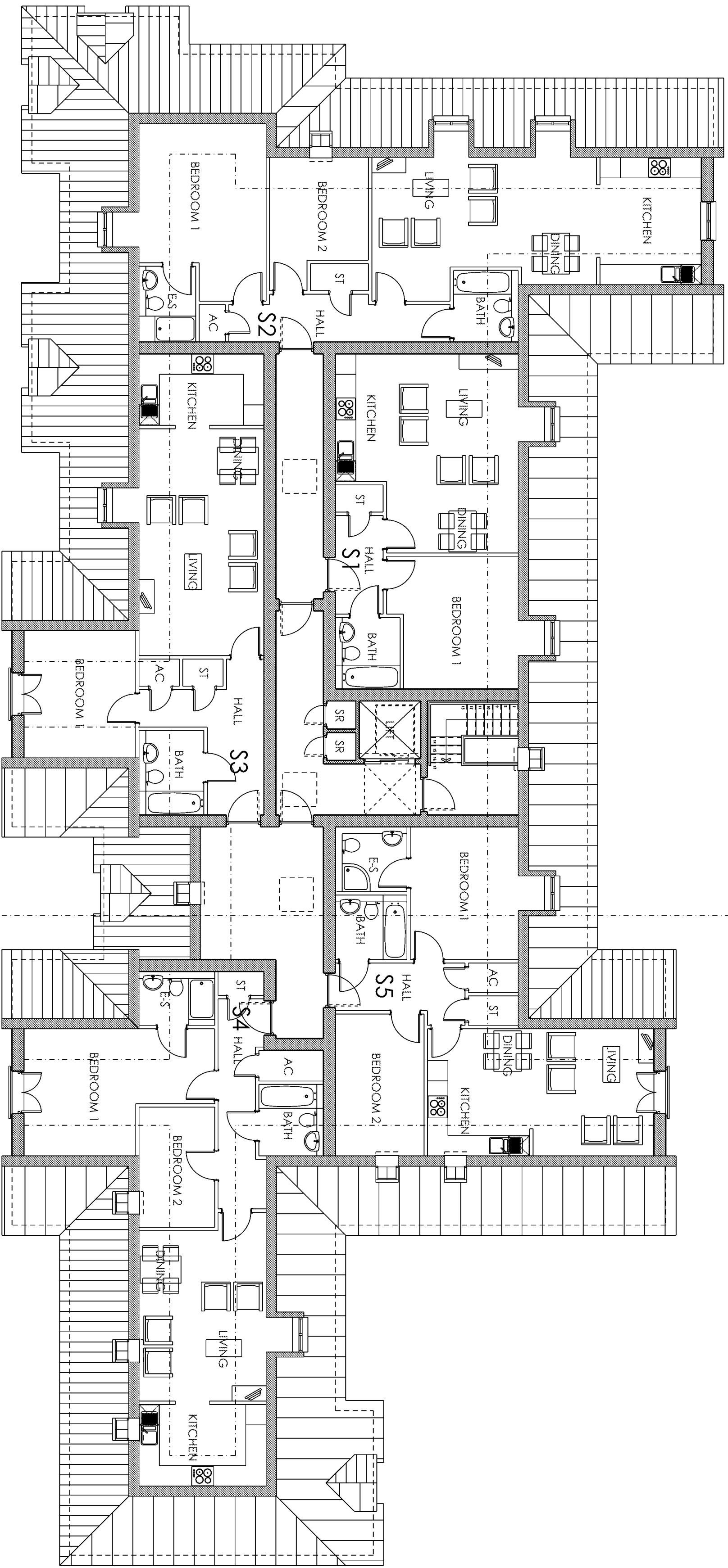
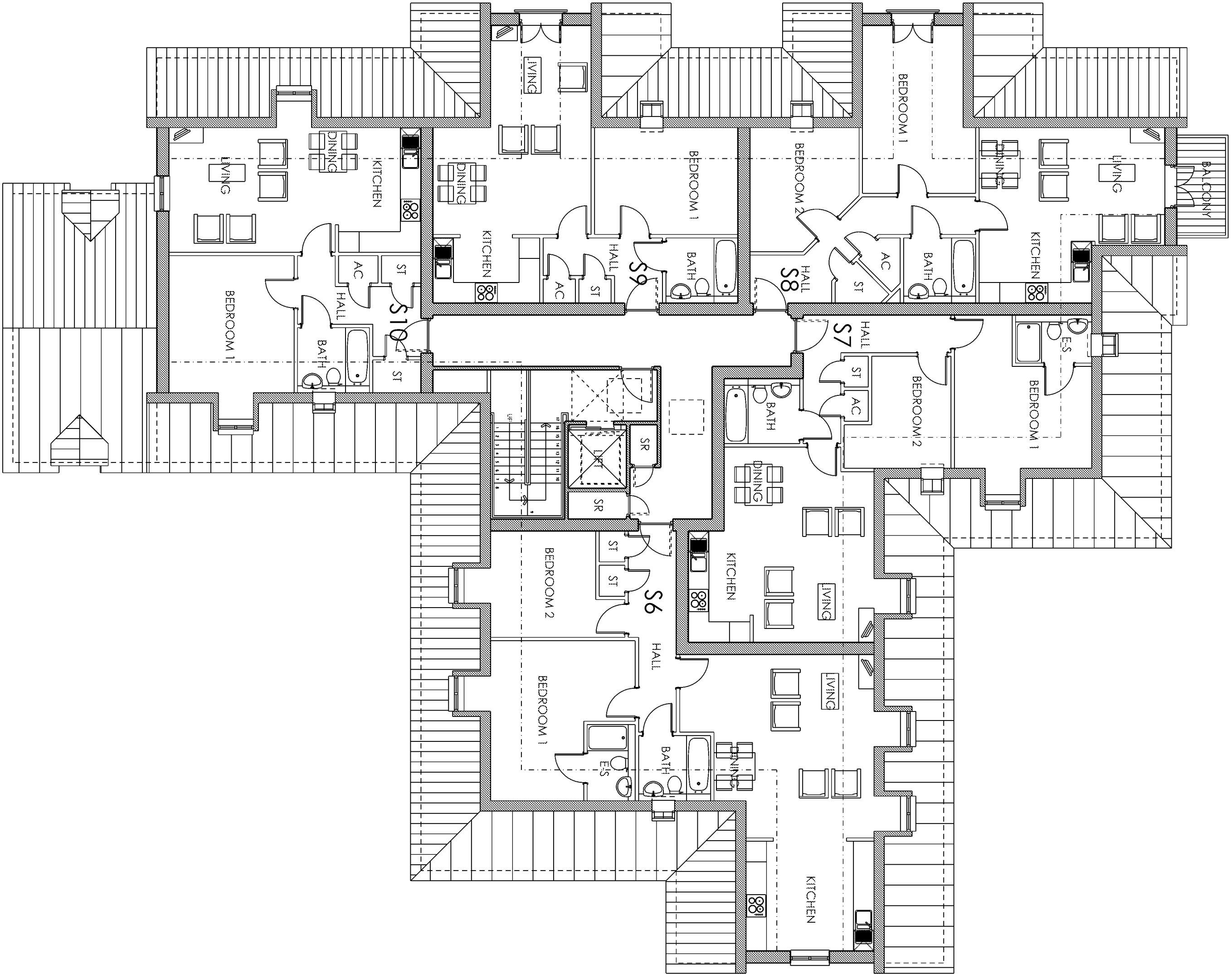
ACCOMMODATION SCHEDULE			
GROUND FLOOR PLAN			
APARTMENT NUMBER	NUMBER OF BEDROOMS	FLOOR AREA SQ. METRES	FLOOR AREA SQ. FEET
G1	2	69.4	747
G2	2	78.8	848
G3	2	79.3	854
G4	2	70.6	760
G5	1	50.0	538
G6	2	70.3	757
G7	2	66.4	715
G8	2	67.8	730
G9	2	72.4	779
G10	2	74.3	800
G11	2	81.8	880
G12	2	76.8	827
G13	1	50.0	538
G14	1	50.0	538

TOTAL = 3 NO. 1 BEDROOM & 11 NO. 2 BEDROOM FLATS



UPPER GROUND FLOOR PLANS

ACCOMMODATION SCHEDULE			
SECOND FLOOR PLAN			
APARTMENT NUMBER	NUMBER OF BEDROOMS	FLOOR AREA SQ. METRES	FLOOR AREA SQ. FEET
S1	1	54.5	587
S2	2	86.6	932
S3	1	63.1	679
S4	2	74.9	806
S5	2	67.6	728
S6	2	86.9	935
S7	2	70.9	763
S8	2	67.0	721
S9	1	54.3	584
S10	1	58.5	630
TOTAL = 4 No. 1 BEDROOM & 6 No. 2 BEDROOM FLATS			



SECOND FLOOR PLANS

POPE PRIESTLEY ARCHITECTS

ARCHITECTURE TOWN PLANNING URBAN DESIGN

UNIT 15, OAKFIELD LANE, BARNET, HERTS AL9 8JH, ENGLAND

RESIDENTIAL DEVELOPMENT

FORD ROAD

ARUNDEL

FOR OAKFORD HOMES

SECOND FLOOR PLANS

PP1249/110-04

P4

PRELIMINARY ISSUE

1:100

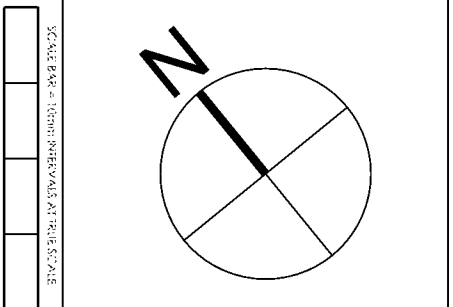
FEB 2019

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PP1249/110-04

P4



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NORTH-WEST ELEVATION TO FORD ROAD

CALIFORNIA
TERRACE



NORTH-EAST ELEVATION TO ACCESS ROAD

SCHEDULE OF MATERIALS - all to LA approval

- WALLS**
1. RED MULTI-SANFACED BRICKWORK.
 2. COMPOSITE WEATHER BOARDING - COLOUR DARK GREY.
 3. FLUSH DIAPER PATTERN BRICKWORK - SMOOTH BLUE HEADERS.
 4. PROJECTING BRICK PLINTH.

- ROOFS**
10. PLAIN BROWN TILES WITH MATCHING HIP AND RIDGE TILES.
 11. DECORATIVE CRESTED RIDGE TILES AS SHOWN.
 12. PLAIN TILED PITCHED ROOF DORMER WITH LEAD CHEEKS.
 13. BLACK PVC-U RAINWATER GOODS.
 14. CONSERVATION STYLE ROOFLIGHT.
 15. GRP ROOF CUPOLA FEATURE.

- EAVES, VERGE & SOFFIT**
20. PROJECTING EAVES AND SOFFIT WITH DECORATIVE BARGEBOARD DETAIL TO VERGES AS SHOWN - COLOUR LIGHT GREY.

- WINDOWS, DOORS, WINDOW HEAD & SILLS**
30. PVC-U DOUBLE GLAZED WINDOWS, PATTERN / STYLE AS SHOWN - COLOUR LIGHT GREY.
 31. PAINTED METAL JULIETTE BALCONY GUARDING WITH GLAZED BALUSTRADE.
 32. RECONSTITUTED DECORATIVE STONE ENTRANCE FEATURE.
 33. RECONSTITUTED STONE MILLION.
 34. PROFILED METAL FRAMED BALCONIES WITH GLAZED BALUSTRADE - COLOUR BLACK.
 35. FACE BRICKWORK JACK-ARCH HEADERS - PLAIN RED SANFACED.
 36. FACE BRICKWORK CURVE-ARCH HEADERS - PLAIN RED SANFACED.
 37. RECONSTITUTED STONE SILLS.
 38. PAINTED METAL GRILLE - COLOUR BLACK.

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SCALE BAR - 10mm INTERVALS AT TRUE SCALE

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SCALE @ A1 1: 100	DATE MAR 2019	AUTHOR AC	CHECK DP	DRAWING NO. PP1249/110-10
				REVISION P4



SOUTH-EAST ELEVATION



CARPORT

SOUTH-EAST ELEVATION

SCHEDULE OF MATERIALS - all to LA approval

WALLS	
1.	RED MULTI-SANFACED BRICKWORK.
2.	COMPOSITE WEATHER BOARDING - COLOUR DARK GREY.
3.	FLUSH DIAPER PATTERN BRICKWORK - SMOOTH BLUE HEADERS.
4.	PROJECTING BRICK PLINTH.
ROOFS	
10.	PLAIN BROWN TILES WITH MATCHING HIP AND RIDGE TILES.
11.	DECORATIVE CRESTED RIDGE TILES AS SHOWN.
12.	PLAIN TILED PITCHED ROOF DORMER WITH LEAD CHEEKS.
13.	BLACK PVC-U RAINWATER GOODS.
14.	CONSERVATION STYLE ROOFLIGHT.
15.	GRP ROOF CUPOLA FEATURE.
EAVES, VERGE & SOFFIT	
20.	PROJECTING EAVES AND SOFFIT WITH DECORATIVE BARGEBOARD DETAIL TO VERGES AS SHOWN - COLOUR LIGHT GREY.

WINDOWS, DOORS, WINDOW HEAD & SILLS	
30.	PVC-U DOUBLE GLAZED WINDOWS, PATTERN / STYLE AS SHOWN - COLOUR LIGHT GREY.
31.	PAINTED METAL JUILLETTE BALCONY GUARDING WITH GLAZED BALUSTRADE.
32.	RECONSTITUTED DECORATIVE STONE ENTRANCE FEATURE.
33.	RECONSTITUTED STONE MULLION.
34.	PROFILED METAL FRAMED BALCONIES WITH GLAZED BALUSTRADE - COLOUR BLACK.
35.	FACE BRICKWORK JACK-ARCH HEADERS - PLAIN RED SANFACED.
36.	FACE BRICKWORK CURVE-ARCH HEADERS - PLAIN RED SANFACED.
37.	RECONSTITUTED STONE SILLS.
38.	PAINTED METAL GRILLE - COLOUR BLACK.

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SCALE BAR = 10mm INTERVALS AT THIS SCALE

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SOUTH-EAST ELEVATIONS	
SCALE 1:100	DATE MAR 2019
AUTHOR AC	DESIGN DP
DRAWING NO. PP1249/110-11	REVISION P4



SECTIONAL SOUTH-WEST ELEVATION

MINIMUM CLEAR HEIGHT 2.5M.



SOUTH-WEST ELEVATION

SCHEDULE OF MATERIALS - all to LA approval

- WALLS**
- RED MULTI-SANFACED BRICKWORK.
 - COMPOSITE WEATHER BOARDING - COLOUR DARK GREY.
 - FLUSH DIAPER PATTERN BRICKWORK - SMOOTH BLUE HEADERS.
 - PROJECTING BRICK PLINTH.
- ROOFS**
- PLAIN BROWN TILES WITH MATCHING HIP AND RIDGE TILES.
 - DECORATIVE CRESTED RIDGE TILES AS SHOWN.
 - PLAIN TILED PITCHED ROOF DORMER WITH LEAD CHEEKS.
 - BLACK PVC-U RAINWATER GOODS.
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 - RECONSTITUTED STONE MILLION.
 - PROFILED METAL FRAMED BALCONIES WITH GLAZED BALUSTRADE - COLOUR BLACK.
 - FACE BRICKWORK JACK-ARCH HEADERS - PLAIN RED SANFACED.
 - FACE BRICKWORK CURVE-ARCH HEADERS - PLAIN RED SANFACED.
 - RECONSTITUTED STONE SILLS.
 - PAINTED METAL GRILLE - COLOUR BLACK.

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SCALE BAR - 10mm INTERVALS AT TRUE SCALE

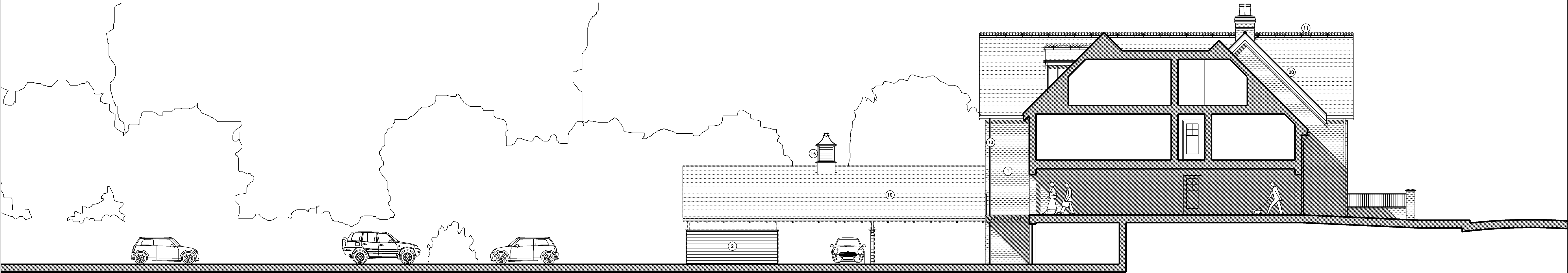
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SCALE B-A1 1: 100	DATE MAR 2019	AUTHOR AC	CHECK DP
DRAWING NO. PP1249/110-12			REVISION P3



NORTH-WEST ELEVATION TO
ACCESS ROAD

CARPORT (SECTIONAL)



CARPORT

NORTH-EAST ELEVATION
(SECTIONAL)

SCHEDULE OF MATERIALS - all to LA approval

WALLS	
1.	RED MULTI-SANFACED BRICKWORK.
2.	COMPOSITE WEATHER BOARDING - COLOUR DARK GREY.
3.	FLUSH DIAPER PATTERN BRICKWORK - SMOOTH BLUE HEADERS.
4.	PROJECTING BRICK PLINTH.
ROOFS	
10.	PLAIN BROWN TILES WITH MATCHING HIP AND RIDGE TILES.
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SCALE 1:100 (TYPICAL) INTERVALS AT 100mm

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PRELIMINARY ISSUE	
RESIDENTIAL DEVELOPMENT FORD ROAD ARUNDEL FOR OAKFORD HOMES	
NORTH-EAST & NORTH-WEST SECTIONAL ELEVATIONS	
SCALE 1:100	DATE: MAR 2019
AUTHOR: AC	DESIGN: DP
DRAWING NO: PP1249/110-13	REVISION: P3

APPENDIX C

TECHNICAL BACKGROUND

H1 Desk Study

Aquifer designation and Source protection zones

Principal aquifer: layers of rock or drift deposit that have high intergranular and/or fracture permeability (usually providing a high level of water storage). They may support water supply and/or river base flow on a strategic scale.

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.

Secondary B aquifer: predominantly lower permeability layers that may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Secondary undifferentiated aquifer: it has not been possible to attribute either a category A or B to a rock type. In most cases this means that it was previously designated as both a minor and non-aquifer in different locations owing to the variable characteristics.

Unproductive' strata: low permeability with negligible significance for water supply or river base flow.

The EA generally adopts a three-fold classification of source protection zones (SPZ) surround abstractions for public water supply. The Site is situated in an area defined as follows:

- Zone 1 or the 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- Zone 2 or the 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants
- Zone 3 or the 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Preliminary risk assessment methodology

LCRM outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) contaminant linkages (contaminant–pathway–receptor) and is used as the basis for the design of the site investigation. The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk. RSK has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

- highly likely: the event appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution
- likely: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
- low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
- unlikely: circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- severe: short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)
- medium: chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem
- mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
- minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the probability of an event occurring and its consequences have been classified, a risk category can be assigned according to the table below.

		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

- very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required
- high: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term
- moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term
- low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild
- very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.

H2 Site Investigation Methodology

Ground gas monitoring

An infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO₂), methane (CH₄) and oxygen (O₂) in percentage by volume, while hydrogen sulphide (H₂S) and carbon monoxide (CO) were recorded in parts per million. Initial and steady state concentrations were recorded. In addition, during the first monitoring round, all wells were screened with a PID to establish if there are any interferences and cross-sensitivity of other hydrocarbons with the infrared gas meter.

Low flow groundwater sampling

Groundwater samples were retrieved using a United States Environment Protection Agency (USEPA) approved low-flow purging and sampling methodology.

The low-flow method relies on moving groundwater through the well screen at approximately the same rate as it flows through the geological formation. This results in a significant reduction in the volume of water extracted before sampling and significantly reduces the amount of disturbance of the water in the monitoring well during purging and sampling. Drawdown levels in the monitoring well and water quality indicator parameters (pH, temperature, electrical conductivity, redox potential and dissolved oxygen) are monitored during low-flow purging and sampling, with stabilisation indicating that purging is complete and sampling can begin. As the flow rate used for purging, in most cases, is the same or only slightly higher than the flow rate used for sampling, and because purging and sampling are conducted as one continuous operation in the field, the process is referred to as low-flow purging and sampling.

Reuse of suitable materials

The Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011) (CoP) was developed in consultation with the Environment Agency and development industry to enable the re-use of materials under certain scenarios and subject to demonstrating that specific criteria are met. The current reuse scenarios covered by the CoP comprise

- reuse on the site of origin (with or without treatment)

- direct transfer of clean and natural soils between sites
- use in the development of land other than the site of origin following treatment at an authorised Hub site (including a fixed soil treatment facility).

The importation of made ground soils (irrespective of contamination status) or crushed demolition materials is not permitted currently under the CoP and requires either a standard rules environmental permit or a U1 waste exemption (see below).

In the context of excavated materials used on-sites undergoing development, four factors are considered to be of particular relevance in determining if the material is a waste or when it ceases to be waste:

- the aim of the Waste Framework Directive is not undermined, i.e. if the use of the material will create an unacceptable risk of pollution of the environment or harm to human health it is likely to be waste
- the material is certain to be used
- the material is suitable for use both chemically and geotechnically
- only the required quantity of material will be used.

The CoP requires the preparation of a materials management plan (MMP) that confirms the above factors will be met. This plan needs to be reviewed by a 'Qualified Person' (QP) who will then issue a declaration form to the EA. As the project progresses, data must be collated and on completion a verification report produced that shows the MMP was followed and describes any changes.

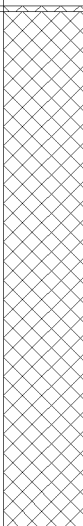
The MMP establishes whether specific materials are classified as waste and how excavated materials will be treated and/or reused in line with the CoP. The MMP is likely to form part of the site waste management plan.

APPENDIX D

EXPLORATORY HOLE RECORDS

BOREHOLE LOG

Contract:		Client:		Borehole:
Arundel Gas Works		Oakford Homes Limited		BH101
Contract Ref:	Start: 07.02.22	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
29780	End: 07.02.22	3.99	E:501276.4 N:106748.4	1 of 3

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
						MADE GROUND: Gravel capping layer underlain by geotextile membrane. (MADE GROUND)	0.04	
0.50	1	B				MADE GROUND: Brownish grey gravelly SAND. Sand is fine to coarse. Gravel is angular to subangular fine to coarse flint with large brick fragments throughout. (MADE GROUND)		
1.00	1	D						
1.20-1.28	1	SPT(c)	NP					
1.75	2	D				. . . At 1.80m becoming reddish brown with increase in sand content.	(3.46)	
2.00-2.08	2	SPT(c)	NP					
2.50	3	D						
3.00-3.08	3	SPT(c)	NP					
							3.50	
3.75	4	D				Off White Structureless CHALK recovered as a slightly gravelly SILT. Gravel is very low density chalk clasts and occasional angular flint cobbles.		
4.00-4.45	4	SPT	N=17			. . . At 4.00m Bands of coarse to cobble size flints.		
4.50	5	D						
5.00-5.45	5	SPT(c)	N=8					
6.00-6.45	6	SPT	N=8					
6.00	6	D						
								
7.50	7	D				. . . Between 7.50m to 9.00m becoming possibly structured with low to medium density chalk clasts.		
8.00-8.45	7	SPT	N=11					

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks		
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)			
						1.20 2.00 2.70	2.00 2.70 3.20	01:00 01:00 01:00	1. Groundwater stike recorded at 6.0m bgl. 2. Drilled to 9m with 8" casing then reduced to 6" with bentonite seal. 3. Installed with groundwater monitoring well - 5m plain and 5m slotted with bentonite seal throughout plain section.		
									All dimensions in metres	Scale: 1:50	
Method Used:	Inspection pit + cable percussion			Plant Used:	Dando 150		Drilled By:	PJD		Logged By: BHawkins	Checked By:  AGS

BOREHOLE LOG

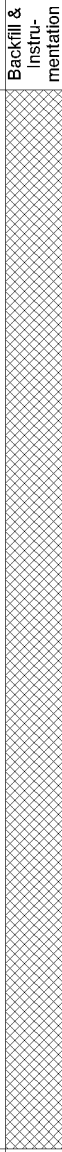
Contract:		Client:		Borehole:
Arundel Gas Works		Oakford Homes Limited		BH101
Contract Ref:	Start: 07.02.22	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
29780	End: 07.02.22	3.99	E:501276.4 N:106748.4	2 of 3

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
9.00	8	D				Off White Structureless CHALK recovered as a slightly gravelly SILT. Gravel is very low density chalk clasts and occasional angular flint cobbles. <i>(stratum copied from 3.50m from previous sheet)</i>		
9.50-9.95	8	SPT	N=11					
10.50	9	D						
11.00-11.45	9	SPT	N=16					
12.00	10	D						
12.50-12.95	10	SPT	N=16					
13.50	11	D						
14.00-14.45	11	SPT	N=19					
15.00	12	D						
15.50-15.95	12	SPT	N=23					
16.50	13	D						
17.00-17.45	13	SPT	N=26					

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks			
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)				
									All dimensions in metres	Scale: 1:50		
Method Used:	Inspection pit + cable percussion			Plant Used:	Dando 150		Drilled By:	PJD	Logged By:	BHawkins	Checked By:	

BOREHOLE LOG

Contract:		Client:		Borehole:
Arundel Gas Works		Oakford Homes Limited		BH101
Contract Ref:	Start: 07.02.22	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
29780	End: 07.02.22	3.99	E:501276.4 N:106748.4	3 of 3

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
18.00	14	D	N=63		Off White Structureless CHALK recovered as a slightly gravelly SILT. Gravel is very low density chalk clasts and occasional angular flint cobbles. <i>(stratum copied from 3.50m from previous sheet)</i>	18.95		
18.50-18.95	14	SPT			White structured CHALK recovered as a silty gravel. Gravel is coarse size medium dense chalk clasts and angular flints. (WHITE CHALK)			
19.50	15	D	. . . At 20.00m some putty chalk layering.		(6.05)			
20.00-20.45	15	SPT(c)				N=52		
21.00	16	D				N=44		
21.50-21.95	16	SPT						
22.50	17	D				N=33		
23.00-23.45	17	SPT						
24.00	18	D				N=55		
25.00-25.45	18	SPT(c)						
Cable percussion borehole terminated at 25.00m depth.						25.00		

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks	
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)		
									</	

BOREHOLE LOG

Contract:		Client:		Borehole:
Arundel Gas Works		Oakford Homes Limited		BH102
Contract Ref:	Start: 08.02.22	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
29780	End: 09.02.22	3.32	E:501310.8 N:106721.6	1 of 3

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
0.50	1	B	N=8			MADE GROUND: Gravel capping layer underlain by geotextile membrane. (MADE GROUND)	0.40	
						MADE GROUND: Firm blackish grey mottled reddish brown gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to medium flint and chalk. (MADE GROUND)	(1.60)	
1.00	2	D						
1.20-1.65	1	SPT(c)						
1.75	3	D						
2.00-2.45	2	SPT(c)						
2.75	4	D						
3.00-3.45	3	SPT(c)						
3.75	5	D						
4.00-4.45	4	SPT(c)						
4.75	6	D						
5.00-5.45	5	SPT(c)						
6.00-6.45	6	SPT(c)						
6.00	7	D						
7.50	8	D						
8.00-8.45	7	SPT(c)						

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks	
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)		
									1. Groundwater strike recorded at 6.0m. 2. Drilled to 9m with 8" casing then reduced to 6" with bentonite seal. 3. Installed with 8m plain pipe and 4m slotted with bentonite seal throughout plain section.	
						All dimensions in metres			Scale:	1:50
Method Used:	Inspection pit + cable percussion			Plant Used:	Pilcon Wayfarer 1500		Drilled By:	PJD	Logged By:	BHawkins
									Checked By:	AGS

BOREHOLE LOG

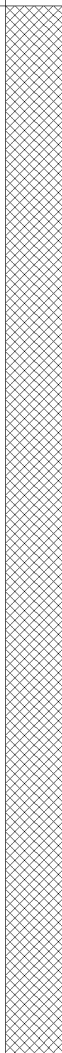
Contract:		Client:		Borehole:
Arundel Gas Works		Oakford Homes Limited		BH102
Contract Ref:	Start: 08.02.22	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
29780	End: 09.02.22	3.32	E:501310.8 N:106721.6	2 of 3

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
9.00	9	D				Off white / yellow structurless CHALK recovered as sandy gravelly SILT. Gravel is fine to coarse size flint and very low density chalk clasts. (WHITE CHALK) <i>(stratum copied from 7.10m from previous sheet)</i> ... Between 9.00m and 12.00m becoming structured chalk ... Between 9.50m and 9.95m rare sand lense. Sand is coarse.		
9.50-9.95	8	SPT	N=10					
10.50	10	D						
11.00-11.45	9	SPT	N=12					
12.00	11	D						
12.50-12.95	10	SPT	N=14					
13.50	12	D						
14.00-14.45	11	SPT	N=33			... At 16.50m rare soft reddish brown gravelly CLAY lense.	(17.90)	
15.00	13	D						
15.50-15.95	12	SPT	N=22					
16.50	14	D						
17.00-17.45	13	SPT	N=23					

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks	
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)		
									All dimensions in metres	Scale: 1:50
Method Used:	Inspection pit + cable percussion			Plant Used:	Pilcon Wayfarer 1500		Drilled By:	PJD	Logged By:	BHawkins

BOREHOLE LOG

Contract:		Client:		Borehole:
Arundel Gas Works		Oakford Homes Limited		BH102
Contract Ref:	Start: 08.02.22	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
29780	End: 09.02.22	3.32	E:501310.8 N:106721.6	3 of 3

Samples and In-situ Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Depth	No	Type	Results					
18.00	15	D	N=27			Off white / yellow structurless CHALK recovered as sandy gravelly SILT. Gravel is fine to coarse size flint and very low density chalk clasts. (WHITE CHALK) (stratum copied from 7.10m from previous sheet)		
18.50-18.95	14	SPT						
19.50	16	D						
20.00-20.45	15	SPT(c)						
21.00	17	D						
21.50-21.95	16	SPT						
22.50	18	D						
23.00-23.45	17	SPT						
24.00	19	D						
25.00-25.45	18	SPT						
			N=58			Cable percussion borehole terminated at 25.00m depth.	25.00	

Boring Progress and Water Observations						Chiselling / Slow Progress			General Remarks				
Date	Time	Borehole Depth	Casing Depth	Borehole Diameter (mm)	Water Depth	From	To	Duration (hh:mm)					
									All dimensions in metres		Scale: 1:50		
Method Used:	Inspection pit + cable percussion			Plant Used:	Pilcon Wayfarer 1500		Drilled By:	PJD		Logged By:	BHawkins	Checked By:	AGS

WINDOW SAMPLE LOG

Contract:		Client:		Window Sample:
Arundel Gas Works		Oakford Homes Limited		WS201
Contract Ref:	Start: 07.02.22	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
29780	End: 07.02.22	3.74	E:501284.4 N:106768.2	1 of 1

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
↑ 0.00 - 1.00 (85mm dia) 100% rec ↓	0.45 0.50-0.50	1	PID ES	128.0ppm 1xT+2xJ+1xV		MADE GROUND: Type 1 granular material underlain by orange geotextile membrane (Capping layer). (MADE GROUND) MADE GROUND: Firm, dark brown locally white gravelly CLAY. Grave is fine to coarse size chalk fragments, flint, brick, ash and clinker. Strong hydrocarbon smell. Fragments of wood encountered at 1.39m (MADE GROUND) Strong hydrocarbon smell	0.11		
↑ 1.00 - 2.00 (75mm dia) 95% rec ↓						(2.09)			
↑ 2.00 - 2.20 (65mm dia) 90% rec ↓						2.20			

Drilling Progress and Water Observations						General Remarks	
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)	1. No groundwater encountered. 2. Installed with 1m plain and 1m slotted pipe with a bentonite seal at the top.	
						All dimensions in metres Scale: 1:25	
Method Used: Tracked window sampling	Plant Used: Archway Competitor		Drilled By: PJ Drilling		Logged By: TCostello	Checked By: 	

WINDOW SAMPLE LOG

Contract: Arundel Gas Works			Client: Oakford Homes Limited		Window Sample: WS202
Contract Ref: 29780	Start: 09.02.22 End: 09.02.22	Ground Level (m AOD): 3.88	National Grid Co-ordinate: E:501283.1 N:106757.3		Sheet: 1 of 1

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
0.00 - 1.00 (85mm dia) 100% rec	0.50-0.50 0.55	1	ES PID	1xT+2xJ+1xV 16.2ppm			Very hard grey sandy poorly graded GRAVEL. Sand is fine to medium. Gravel is angular to sub-rounded, fine to coarse crushed rock aggregate [ENGINEERED FILL] MADE GROUND: Type 1 granular material underlain by orange geotextile membrane (Capping layer). (MADE GROUND) MADE GROUND: Firm, dark brown locally white gravelly CLAY. Grave is angular to rounded, fine to coarse chalk, flint, brick, ash, clinker and ash with rootlets throughout Slight hydrocarbon smell	0.20 0.21 (1.27)	
1.00 - 2.00 (75mm dia) 90% rec	1.30-1.30	2	ES	1xT+2xJ+1xV			MADE GROUND: Light grey locally brown sandy clayey GRAVEL. Sand is fine to medium. Gravel is angular to sub-rounded, fine to medium occasionally coarse flint, red brick ash and clicker with rare rootlets in part.	1.48 (0.95)	
2.00 - 3.00 (65mm dia) 80% rec							MADE GROUND: Yellowish brown clayey gravelly fine to medium SAND. Gravel is angular to rounded, fine to medium coal, brick and ash MADE GROUND: Light grey locally white clayey fine to medium SAND.	2.43 2.63 (0.37)	
								3.00	

Drilling Progress and Water Observations						General Remarks				
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)					
						1. No groundwater encountered. 2. Installed with 1m plain and 2m slotted pipe with bentonite seal at the top.				
						All dimensions in metres		Scale:	1:25	
Method Used: Tracked window sampling		Plant Used: Archway Competitor		Drilled By: PJ DRILLING		Logged By: TCostello		Checked By: 		

WINDOW SAMPLE LOG

Contract: Arundel Gas Works			Client: Oakford Homes Limited		Window Sample: WS203
Contract Ref: 29780	Start: 07.02.22 End: 07.02.22	Ground Level (m AOD): 3.64	National Grid Co-ordinate: E:501299.5 N:106747.9		Sheet: 1 of 1

Progress		Samples / Tests			Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
0.00 - 1.00 (85mm dia) 80% rec	0.40 0.45-0.45	1	PID ES	0.1ppm 1xT+2xJ+1xV			MADE GROUND: Type 1 granular material underlain by orange geotextile membrane (Capping layer) (MADE GROUND)	(0.31) 0.31	
1.00 - 2.00 (75mm dia) 90% rec	1.50-1.50	2	ES	1xT+2xJ+1xV			MADE GROUND: Firm, dark brown locally white gravelly CLAY. Gravel is angular to rounded, fine to coarse chalk, flint, brick, ash, clinker and ash with rootlets throughout (MADE GROUND)	(1.34) 1.65	
2.00 - 3.00 (65mm dia) 95% rec							Firm brownish orange slightly sandy very gravelly CLAY. Sand is fine to medium. Gravel is angular to sub-rounded, fine to coarse flint [REWORKED ALLUVIUM]	(0.95) 2.60	
							Firm brownish orange very gravelly CLAY. Gravel is angular to sub-rounded, fine to coarse flint [ALLUVIUM]	(0.40) 3.00	

Drilling Progress and Water Observations						General Remarks
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)	
						</



Contract:		Client:		Window Sample:
Arundel Gas Works		Oakford Homes Limited		WS204
Contract Ref:	Start: 09.02.22	Ground Level (m AOD):	National Grid Co-ordinate:	Sheet:
29780	End: 09.02.22	3.24	E:501314.5 N:106735.7	1 of 1

[illegible]

Drilling Progress and Water Observations						General Remarks
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)	
						1. No groundwater encountered.
						2. Installed with 1m plain and 1m slotted pipe with a bentonite seal at the top.
						</

WINDOW SAMPLE LOG

Contract: Arundel Gas Works			Client: Oakford Homes Limited		Window Sample: WS205
Contract Ref: 29780	Start: 07.02.22 End: 07.02.22	Ground Level (m AOD): 3.61	National Grid Co-ordinate: E:501290.9 N:106730.4		Sheet: 1 of 1

Progress		Samples / Tests			Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
0.00 - 1.00 (85mm dia) 85% rec							MADE GROUND: Type 1 granular material underlain by orange geotextile membrane (Capping layer) (MADE GROUND)	(0.61)	
	0.65-0.65 0.65	1	ES PID	1xT+2xJ+1xV 0.9ppm			MADE GROUND: Firm orangish brown sandy gravelly CLAY. Sand is fine. Gravel is angular to sub-rounded, fine to medium flint, brick, clinker, ash and rootlets throughout	0.61 0.75 0.85	
1.00 - 2.00 (75mm dia) 90% rec							MADE GROUND: Very hard, orangish red GRAVEL. Gravel is angular, coarse to cobble size fragments of red brick	(0.85)	
	1.60-1.60 1.60	2	ES PID	1xT+2xJ+1xV 0.0ppm			MADE GROUND: Firm, dark brown locally white gravelly CLAY. Gravel is angular to rounded, fine to coarse chalk, flint, brick, ash, clinker and ash with rootlets throughout (MADE GROUND)	1.70	
2.00 - 3.00 (65mm dia) 95% rec							Firm orangish brown slightly sandy gravelly CLAY. Sand is fine to medium, Gravel is angular to sub-rounded, fine to medium flint [ALLUVIAL DEPOSITS]	(0.80)	
							Soft locally firm orangish brown slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is angular to rounded, fine to medium flint [ALLUVIAL DEPOSITS]	2.50 (0.50)	
								3.00	

Drilling Progress and Water Observations						General Remarks	
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)		
						1. No groundwater encountered. 2. Installed with 1m plain and 2m slotted pipe with a benonite seal at the top.	
All dimensions in metres						Scale:	1:25
Method Used: Tracked window sampling	Plant Used: Archway Competitor		Drilled By: PJ Drilling		Logged By: TCostello	Checked By:	

WINDOW SAMPLE LOG

Contract: Arundel Gas Works			Client: Oakford Homes Limited		Window Sample: WS206
Contract Ref: 29780	Start: 07.02.22 End: 07.02.22	Ground Level (m AOD): 3.75	National Grid Co-ordinate: E:501273.9 N:106732.9		Sheet: 1 of 1

Progress	Samples / Tests				Water	Backfill & Instrumentation	Description of Strata	Depth (Thickness)	Material Graphic Legend
Window Run	Depth	No	Type	Results					
0.00 - 1.00 (85mm dia) 95% rec 1.00 - 2.00 (75mm dia) 90% rec	0.55		PID	1.5ppm			MADE GROUND: Type 1 granular material underlain by orange geotextile membrane (Capping layer). (MADE GROUND)	(0.41)	
							Firm, dark brown locally white gravelly CLAY. Gravel is angular to rounded, fine to coarse chalk, flint, brick, ash, clinker and ash with rootlets throughout [MADE GROUND] (MADE GROUND)	(0.99)	
	1.30-0.50	1	ES	1xT+2xJ+1xV			Firm orangish brown very gravelly CLAY. Gravel is angular to sub-rounded, fine to medium occasionally coarse flint. [POSSIBLE REWORKED ALLUVIAL DEPOSITS]	1.40	
	1.30-1.30	2	ES	1xT+2xJ+1xV				(0.60)	
								2.00	

Drilling Progress and Water Observations						General Remarks			
Date	Time	Borehole Depth (m)	Casing Depth (m)	Borehole Diameter (mm)	Water Depth (m)				
						1. SPT refusal at 2.00mgl			
						All dimensions in metres Scale: 1:25			
Method Used: Tracked window sampling	Plant Used: Archway Competitor		Drilled By: PJ DRILLING		Logged By: TCostello		Checked By: 		

APPENDIX E FIELD RECORDS

GAS MONITORING RESULTS - FIELD SHEET

Pre-Testing Remarks:		Weather: <u>Sunny</u>		Air Temperature:		Post-Testing Remarks		Samples taken	
Pressure: <u>RISING</u> <u>CONSTANT</u> <u>FALLING</u>		Ground Conditions: <u>dry</u>		Equipment Used: <u>GA 5000</u>					
Measurement datum: <u>GL</u> <u>Top of pipe / Other</u>		Wind: <u>Sl. breeze</u>		Data Collected By: <u>[Redacted]</u>				Sampling method:	
Offset to GL (m):									

Exploratory Position ID	Pipe ref & Pipe diameter	Monitoring Round / Test Number	Date & Time of Monitoring dd/mm/yyyy hh:mm	Gas Flow (l/hr)	Atmos Pressure (mb)	Differential Pressure (mb)	Borehole Pressure (mb)	LEL (%)	Methane (%/vol)	Carbon Dioxide (%/vol)	Oxygen (%/vol)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	PID (ppm)	Depth to water (m)	Depth to well base (m)
M2201	19 mm		17/2/22 9.15	Initial	1011	0.02										
				Steady												
				0	<0.1				20.1	21.0	0	0	0	0		
				15	<0.1				0.4	0.1	1.2	27	0	126.3		
				30	<0.1				0.4	0.1	0.2	27	0	187.3		
				60	<0.1				0.4	0.1	0.2	27	0	300.3		
				90					0.4	0.1	0.1	29	0	347.3		
				120					0.4	0.1	0.1	30	0	378.2		
				180					0.4	0.1	0.1	31	0	416.1		
				240												
				300												
				360												
				420												

		Compiled Date	Compiled By	Checked	Contract Ref.
		17/2/22			
Contract:		Page: of			
		Engineer:			

GAS MONITORING RESULTS - FIELD SHEET

<u>Pre-Testing Remarks:</u> Pressure: RISING CONSTANT FALLING Measurement datum: <u>GL / (top of pipe) / Other</u> Offset to GL (m): <u>4.00</u>		<u>Weather:</u> <u>Sunny</u> <u>Ground Conditions:</u> <u>damp</u> <u>Wind:</u> <u>breezy</u>	<u>Air Temperature:</u> <u>Equipment Used:</u> <u>GA 5000</u> <u>Calibration date:</u> <u>Data Collected By:</u>	<u>Post-Testing Remarks:</u> 	<u>Samples taken</u>
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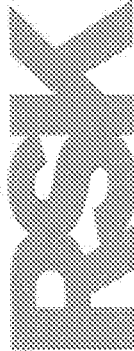
Exploratory Position ID	Pipe ref & Pipe diameter	Monitoring Round / Test Number	Date & Time of Monitoring dd/mm/yyyy hh:mm:ss	Gas Flow (l/hr)	Atmos Pressure (mb)	Differential Pressure (mb)	Borehole Pressure (mb)	LEL (%)	Methane (%vol)	Carbon Dioxide (%vol)	Oxygen (%vol)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	PID (ppm)	Depth to water (m)	Depth to well base (m)		
WS202			17/2/22	Initial	1011	0.05												
			9:47	Steady														
			0	20.1	20.6	0	0											
			15	20.1	16.2	0	0	40.8										
			30	20.1	14.1	0	0	89.4										
			60	20.1	10.0	0	0	35.6										
			90		6.0	0	0	31.1										
			120		3.4	0	0	27.8										
			180		0.2	0	0	24.1										
			240		0.1	0	0	22.9										
			300															
			360															
420																		

	Compiled Date	Compiled By	Checked	Contract Ref:
	Contract: _____ Page: _____ of _____ Engineer: _____			

GAS MONITORING RESULTS - FIELD SHEET

Pre-Testing Remarks:		Weather: <u>Sunny</u>		Air Temperature:		Post-Testing Remarks		Samples taken	
Pressure:	RISING	CONSTANT	FALLING	Equipment Used: <u>GA5000</u>					
Measurement datum:	Offset to GL (m):			Calibration date:					
GL (top of pipe) Other	- 0.01			Data Collected By: <u>[Redacted]</u>				Sampling method:	
Ground Conditions: <u>damp</u>				Wind: <u>wee breezy</u>					

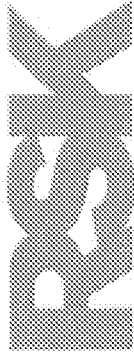
Exploratory Position ID	Pipe ref & Pipe diameter	Monitoring Round / Test Number	Date & Time of Monitoring dd/mm/yyyy hh:mm:ss	Gas Flow (l/hr)	Atmos Pressure (mb)	Differential Pressure (mb)	Borehole Pressure (mb)	LEL (%)	Methane (%vol)	Carbon Dioxide (%vol)	Oxygen (%vol)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	PID (ppm)	Depth to water (m)	Depth to well base (m)
W3206			17/12/22	Initial	1010	0.03										
				Steady												
			0	40.1					40.1	20.1	20.6	0	0	0		
			15	40.1					40.3	2.0	11.2	0	0	25.1		
			30	40.1					0.3	2.0	6.1	0	0	21.8		
			60	40.1					0.3	2.1	5.7	0	0	19.4		
			90						0.3	2.1	5.5	0	0	17.9		
			120						0.3	2.2	5.4	0	0	16.5		
			180						0.3	2.2	5.0	0	0	13.6		
			240													
			300													
			360													
			420													

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GAS MONITORING RESULTS - FIELD SHEET

Pre-Testing Remarks:		Weather: <i>Sunny</i>		Air Temperature:		Post-Testing Remarks		Samples taken	
Pressure:	RISING	CONSTANT	FALLING	Equipment Used: <i>GA5000</i>					
Measurement datum:				Ground Conditions: <i>damp</i>					
GL / Top of pipe / Other				Wind: <i>breezy</i>		Data Collected By: [REDACTED]		Sampling method:	
Offset to GL (m): <i>0.05</i>									

Exploratory Position ID	Pipe ref & Pipe diameter	Monitoring Round / Test Number	Date & Time of Monitoring dd/mm/yyyy hh:mm:ss	Gas Flow (l/hr)	Atmos Pressure (mb)	Differential Pressure (mb)	Borehole Pressure (mb)	LEL (%)	Methane (%vol)	Carbon Dioxide (%vol)	Oxygen (%vol)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	PID (ppm)	Depth to water (m)	Depth to well base (m)
WS205			17/12/22	Initial	1011	0.10										
			10:14	Steady												
			0	20.1					20.1	0.1	20.6	0	0	0		
			15	34					0.3	0.3	19.8	0	0	19.8		
			30	5.5					0.4	0.3	19.2	0	0	16.1		
			60	5.9					0.4	0.3	19.1	0	0	14.2		
			90	6.2					0.8	0.3	18.4	0	0	11.7		
			120	6.3					2.0	0.3	13.1	1	0	8.0		
			180	6.4					3.1	0.2	8.1	1	0	5.5		
			240						7.5	0.5	4.3	1	0	4.0		
		300						7.8	0.8	3.7	3	0	3.0			
		360						12.7	1.2	4.6	1	0	1.9			
		420														

		Compiled Date		Compiled By		Checked		Contract Ref:	
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GAS MONITORING RESULTS - FIELD SHEET

Pre-Testing Remarks: Pressure: RISING CONSTANT FALLING Measurement datum: Offset to GL (m): GL Top of pipe / Other + 0.01		Weather: Sunny Ground Conditions: damp Wind: Sl. breeze	Air Temperature: Equipment Used: GASCO Calibration date: [REDACTED] Data Collected By: [REDACTED]	Post-Testing Remarks:	Samples taken Sampling method:
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Exploratory Position ID	Pipe ref & Pipe diameter	Monitoring Round / Test Number	Date & Time of Monitoring dd/mm/yyyy hh:mm:ss	Gas Flow (l/hr)	Atmos Pressure (mb)	Differential Pressure (mb)	Borehole Pressure (mb)	LEL (%)	Methane (%vol)	Carbon Dioxide (%vol)	Oxygen (%vol)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	PID (ppm)	Depth to water (m)	Depth to well base (m)
WS203			17/2/22 10:33	Initial	1011	0.00										
				Steady												
			0	<0.1					20.1	20.6	0	0	0	0		
			15	<0.1					0.5	3.5	18.2	0	0	12.3		
			30	<0.1					0.5	3.5	15.7	1	0	11.4		
			60	<0.1					0.4	3.2	15.8	1	0	10.2		
			90						0.4	3.0	16.1	3	0	9.2		
			120						0.4	3.2	14.7	7	0	8.1		
			180						0.6	4.0	11.4	10	0	6.9		
			240						0.5	4.1	11.6	8	0	6.3		
		300						0.5	4.1	11.7	6	0	5.6			
		360														
		420														

		Compiled Date 	Compiled By 	Checked 	Contract Ref
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GAS MONITORING RESULTS - FIELD SHEET

Pre-Testing Remarks:		Weather: <u>Sunny</u>		Air Temperature:		Post-Testing Remarks		Samples taken	
Pressure: <u>RISING</u> <u>CONSTANT</u> <u>FALLING</u>		Ground Conditions: <u>damp</u>		Equipment Used: <u>GA5000</u>					
Measurement datum: <u>GL (Top of pipe / Other)</u>		Wind: <u>breezy</u>		Calibration date: <u>[REDACTED]</u>				Sampling method:	
Offset to GL (m): <u>+0.05</u>		Data Collected By:							

Exploratory Position ID	Pipe ref & Pipe diameter	Monitoring Round / Test Number	Date & Time of Monitoring dd/mm/yyyy hh:mm:ss	Gas Flow (l/hr)	Atmos Pressure (mb)	Differential Pressure (mb)	Borehole Pressure (mb)	LEL (%)	Methane (%/vol)	Carbon Dioxide (%/vol)	Oxygen (%/vol)	Carbon Monoxide (ppm)	Hydrogen Sulphide (ppm)	PID (ppm)	Depth to water (m)	Depth to well base (m)
WS204			17/2/22	Initial	1011	8.03										
			10:44	Steady					20.1	21.0	21.0	0	0	0		
			15	20.1					20.1	20.8	20.8	0	0	10.8		
			30	20.1					20.1	20.8	20.8	0	0	8.9		
			60						20.1	20.7	20.7	0	0	8.0		
			90						20.1	20.7	20.7	0	0	7.3		
			120						20.1	20.7	20.7	0	0	6.8		
			180													
			240													
			300													
			360													
			420													

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Low-Flow Test Report:

Test Date / Time: 17/02/2022 10:30:11
Project:
Operator Name:

Location Name: Bh104 Initial Depth to Water: 1 m	Estimated Total Volume Pumped: 165 ml Flow Cell Volume: 130 ml Final Flow Rate: 30 ml/min Final Draw Down: 0 m	Instrument Used: Aqua TROLL 500 Serial Number: 824599
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
17/02/2022 10:30	00:00	7.48 pH	11.04 °C	489.34 µS/cm	7.91 mg/L	357.82 NTU	170.8 mV	100.00 cm	30.00 ml/min
17/02/2022 10:30	00:30	7.49 pH	11.03 °C	492.18 µS/cm	7.89 mg/L	313.51 NTU	170.9 mV	100.00 cm	30.00 ml/min
17/02/2022 10:31	01:00	7.49 pH	10.97 °C	491.61 µS/cm	7.84 mg/L	359.47 NTU	169.8 mV	100.00 cm	30.00 ml/min
17/02/2022 10:31	01:30	7.48 pH	10.91 °C	491.25 µS/cm	7.84 mg/L	346.66 NTU	168.9 mV	100.00 cm	30.00 ml/min
17/02/2022 10:32	02:00	7.49 pH	10.85 °C	487.93 µS/cm	7.85 mg/L	366.00 NTU	168.5 mV	100.00 cm	30.00 ml/min
17/02/2022 10:32	02:30	7.48 pH	10.84 °C	492.20 µS/cm	7.80 mg/L	288.87 NTU	170.8 mV	100.00 cm	30.00 ml/min
17/02/2022 10:33	03:00	7.48 pH	10.84 °C	491.33 µS/cm	7.73 mg/L	268.14 NTU	171.7 mV	100.00 cm	30.00 ml/min
17/02/2022 10:33	03:30	7.48 pH	10.82 °C	490.06 µS/cm	7.73 mg/L	276.27 NTU	172.3 mV	100.00 cm	30.00 ml/min
17/02/2022 10:34	04:00	7.48 pH	10.80 °C	492.66 µS/cm	7.75 mg/L	296.54 NTU	171.1 mV	100.00 cm	30.00 ml/min
17/02/2022 10:34	04:30	7.48 pH	10.80 °C	493.87 µS/cm	7.74 mg/L	309.47 NTU	172.0 mV	100.00 cm	30.00 ml/min
17/02/2022 10:35	05:00	7.48 pH	10.78 °C	492.08 µS/cm	7.73 mg/L	309.03 NTU	174.1 mV	100.00 cm	30.00 ml/min
17/02/2022 10:35	05:30	7.47 pH	10.78 °C	493.03 µS/cm	7.71 mg/L	307.33 NTU	176.6 mV	100.00 cm	30.00 ml/min

Samples

Sample ID:	Description:
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Low-Flow Test Report:

Test Date / Time: 17/02/2022 11:01:55
Project:
Operator Name:

Location Name: Bh105 Initial Depth to Water: 0.65 m	Estimated Total Volume Pumped: 1020 ml Flow Cell Volume: 130 ml Final Flow Rate: 30 ml/min Final Draw Down: 0 m	Instrument Used: Aqua TROLL 500 Serial Number: 824599
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
17/02/2022 11:01	00:00	6.94 pH	11.53 °C	1,220.3 µS/cm	0.54 mg/L	367.47 NTU	-10.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:02	00:30	6.95 pH	11.52 °C	1,223.9 µS/cm	0.47 mg/L	389.69 NTU	-13.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:02	01:00	6.95 pH	11.46 °C	1,232.4 µS/cm	0.46 mg/L	390.42 NTU	-15.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:03	01:30	6.95 pH	11.45 °C	1,235.4 µS/cm	0.45 mg/L	392.70 NTU	-19.2 mV	65.00 cm	30.00 ml/min
17/02/2022 11:03	02:00	6.94 pH	11.46 °C	1,239.4 µS/cm	0.43 mg/L	403.49 NTU	-21.8 mV	65.00 cm	30.00 ml/min
17/02/2022 11:04	02:30	6.95 pH	11.46 °C	1,241.1 µS/cm	0.41 mg/L	419.12 NTU	-24.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:04	03:00	6.95 pH	11.47 °C	1,244.8 µS/cm	0.40 mg/L	410.11 NTU	-26.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:05	03:30	6.94 pH	11.46 °C	1,255.7 µS/cm	0.38 mg/L	414.97 NTU	-28.8 mV	65.00 cm	30.00 ml/min
17/02/2022 11:05	04:00	6.94 pH	11.48 °C	1,255.5 µS/cm	0.38 mg/L	380.51 NTU	-30.1 mV	65.00 cm	30.00 ml/min
17/02/2022 11:06	04:30	6.94 pH	11.49 °C	1,256.3 µS/cm	0.36 mg/L	447.53 NTU	-31.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:06	05:00	6.94 pH	11.52 °C	1,260.4 µS/cm	0.35 mg/L	419.07 NTU	-33.5 mV	65.00 cm	30.00 ml/min
17/02/2022 11:07	05:30	6.94 pH	11.53 °C	1,264.6 µS/cm	0.34 mg/L	434.79 NTU	-34.8 mV	65.00 cm	30.00 ml/min
17/02/2022 11:07	06:00	6.94 pH	11.54 °C	1,271.7 µS/cm	0.33 mg/L	419.14 NTU	-36.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:08	06:30	6.94 pH	11.53 °C	1,275.2 µS/cm	0.32 mg/L	432.66 NTU	-38.6 mV	65.00 cm	30.00 ml/min
17/02/2022 11:08	07:00	6.94 pH	11.54 °C	1,272.4 µS/cm	0.31 mg/L	452.33 NTU	-41.3 mV	65.00 cm	30.00 ml/min
17/02/2022 11:09	07:30	6.95 pH	11.54 °C	1,269.9 µS/cm	0.30 mg/L	460.94 NTU	-44.0 mV	65.00 cm	30.00 ml/min
17/02/2022 11:09	08:00	6.95 pH	11.53 °C	1,270.2 µS/cm	0.29 mg/L	458.09 NTU	-45.2 mV	65.00 cm	30.00 ml/min

17/02/2022 11:10	08:30	6.94 pH	11.53 °C	1,276.7 µS/cm	0.29 mg/L	439.64 NTU	-46.5 mV	65.00 cm	30.00 ml/min
17/02/2022 11:10	09:00	6.95 pH	11.54 °C	1,278.1 µS/cm	0.28 mg/L	412.38 NTU	-47.9 mV	65.00 cm	30.00 ml/min
17/02/2022 11:11	09:30	6.95 pH	11.56 °C	1,265.1 µS/cm	0.28 mg/L	422.81 NTU	-51.3 mV	65.00 cm	30.00 ml/min
17/02/2022 11:11	10:00	6.95 pH	11.56 °C	1,259.7 µS/cm	0.28 mg/L	445.03 NTU	-53.8 mV	65.00 cm	30.00 ml/min
17/02/2022 11:12	10:30	6.95 pH	11.56 °C	1,261.6 µS/cm	0.27 mg/L	401.82 NTU	-55.1 mV	65.00 cm	30.00 ml/min
17/02/2022 11:12	11:00	6.95 pH	11.56 °C	1,261.9 µS/cm	0.27 mg/L	413.55 NTU	-55.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:13	11:30	6.95 pH	11.57 °C	1,264.0 µS/cm	0.26 mg/L	426.19 NTU	-55.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:13	12:00	6.95 pH	11.56 °C	1,268.6 µS/cm	0.26 mg/L	400.61 NTU	-55.9 mV	65.00 cm	30.00 ml/min
17/02/2022 11:14	12:30	6.95 pH	11.57 °C	1,271.1 µS/cm	0.26 mg/L	368.09 NTU	-56.1 mV	65.00 cm	30.00 ml/min
17/02/2022 11:14	13:00	6.95 pH	11.57 °C	1,273.8 µS/cm	0.25 mg/L	348.78 NTU	-56.6 mV	65.00 cm	30.00 ml/min
17/02/2022 11:15	13:30	6.95 pH	11.56 °C	1,269.7 µS/cm	0.25 mg/L	371.74 NTU	-57.5 mV	65.00 cm	30.00 ml/min
17/02/2022 11:15	14:00	6.95 pH	11.56 °C	1,275.3 µS/cm	0.25 mg/L	350.44 NTU	-57.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:16	14:30	6.95 pH	11.56 °C	1,277.5 µS/cm	0.25 mg/L	348.58 NTU	-58.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:16	15:00	6.95 pH	11.58 °C	1,273.0 µS/cm	0.24 mg/L	326.13 NTU	-59.2 mV	65.00 cm	30.00 ml/min
17/02/2022 11:17	15:30	6.95 pH	11.57 °C	1,272.4 µS/cm	0.24 mg/L	325.29 NTU	-59.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:17	16:00	6.95 pH	11.59 °C	1,277.4 µS/cm	0.24 mg/L	334.25 NTU	-60.1 mV	65.00 cm	30.00 ml/min
17/02/2022 11:18	16:30	6.95 pH	11.59 °C	1,281.6 µS/cm	0.24 mg/L	312.44 NTU	-60.2 mV	65.00 cm	30.00 ml/min
17/02/2022 11:18	17:00	6.95 pH	11.59 °C	1,274.8 µS/cm	0.23 mg/L	300.05 NTU	-60.3 mV	65.00 cm	30.00 ml/min
17/02/2022 11:19	17:30	6.95 pH	11.58 °C	1,272.9 µS/cm	0.23 mg/L	297.44 NTU	-60.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:19	18:00	6.95 pH	11.57 °C	1,276.1 µS/cm	0.23 mg/L	266.15 NTU	-61.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:20	18:30	6.95 pH	11.57 °C	1,278.5 µS/cm	0.23 mg/L	263.25 NTU	-61.9 mV	65.00 cm	30.00 ml/min
17/02/2022 11:20	19:00	6.95 pH	11.57 °C	1,281.0 µS/cm	0.23 mg/L	266.15 NTU	-61.9 mV	65.00 cm	30.00 ml/min
17/02/2022 11:21	19:30	6.95 pH	11.57 °C	1,279.6 µS/cm	0.23 mg/L	245.33 NTU	-62.5 mV	65.00 cm	30.00 ml/min
17/02/2022 11:21	20:00	6.95 pH	11.58 °C	1,271.1 µS/cm	0.23 mg/L	243.66 NTU	-62.8 mV	65.00 cm	30.00 ml/min
17/02/2022 11:22	20:30	6.95 pH	11.60 °C	1,275.0 µS/cm	0.22 mg/L	221.36 NTU	-62.8 mV	65.00 cm	30.00 ml/min
17/02/2022 11:22	21:00	6.95 pH	11.61 °C	1,279.2 µS/cm	0.22 mg/L	216.98 NTU	-63.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:23	21:30	6.95 pH	11.61 °C	1,279.9 µS/cm	0.22 mg/L	215.64 NTU	-63.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:23	22:00	6.95 pH	11.60 °C	1,278.0 µS/cm	0.22 mg/L	206.09 NTU	-63.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:24	22:30	6.95 pH	11.59 °C	1,279.1 µS/cm	0.22 mg/L	196.59 NTU	-63.7 mV	65.00 cm	30.00 ml/min

17/02/2022 11:24	23:00	6.95 pH	11.58 °C	1,281.3 µS/cm	0.22 mg/L	201.91 NTU	-63.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:25	23:30	6.95 pH	11.58 °C	1,281.3 µS/cm	0.22 mg/L	190.43 NTU	-64.0 mV	65.00 cm	30.00 ml/min
17/02/2022 11:25	24:00	6.95 pH	11.59 °C	1,281.9 µS/cm	0.22 mg/L	200.45 NTU	-64.2 mV	65.00 cm	30.00 ml/min
17/02/2022 11:26	24:30	6.95 pH	11.59 °C	1,286.5 µS/cm	0.22 mg/L	181.54 NTU	-64.5 mV	65.00 cm	30.00 ml/min
17/02/2022 11:26	25:00	6.95 pH	11.60 °C	1,282.0 µS/cm	0.21 mg/L	179.24 NTU	-65.0 mV	65.00 cm	30.00 ml/min
17/02/2022 11:27	25:30	6.95 pH	11.60 °C	1,286.2 µS/cm	0.21 mg/L	154.88 NTU	-64.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:27	26:00	6.95 pH	11.62 °C	1,287.1 µS/cm	0.21 mg/L	153.32 NTU	-64.9 mV	65.00 cm	30.00 ml/min
17/02/2022 11:28	26:30	6.95 pH	11.62 °C	1,285.2 µS/cm	0.21 mg/L	153.36 NTU	-64.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:28	27:00	6.95 pH	11.62 °C	1,289.4 µS/cm	0.21 mg/L	165.79 NTU	-64.0 mV	65.00 cm	30.00 ml/min
17/02/2022 11:29	27:30	6.95 pH	11.61 °C	1,284.3 µS/cm	0.21 mg/L	140.40 NTU	-64.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:29	28:00	6.95 pH	11.62 °C	1,284.5 µS/cm	0.21 mg/L	133.24 NTU	-65.1 mV	65.00 cm	30.00 ml/min
17/02/2022 11:30	28:30	6.95 pH	11.62 °C	1,285.1 µS/cm	0.21 mg/L	127.15 NTU	-64.9 mV	65.00 cm	30.00 ml/min
17/02/2022 11:30	29:00	6.95 pH	11.62 °C	1,285.2 µS/cm	0.21 mg/L	148.34 NTU	-64.8 mV	65.00 cm	30.00 ml/min
17/02/2022 11:31	29:30	6.95 pH	11.62 °C	1,284.3 µS/cm	0.21 mg/L	138.83 NTU	-64.5 mV	65.00 cm	30.00 ml/min
17/02/2022 11:31	30:00	6.95 pH	11.61 °C	1,285.0 µS/cm	0.21 mg/L	128.85 NTU	-64.7 mV	65.00 cm	30.00 ml/min
17/02/2022 11:32	30:30	6.95 pH	11.63 °C	1,285.9 µS/cm	0.20 mg/L	126.61 NTU	-64.2 mV	65.00 cm	30.00 ml/min
17/02/2022 11:32	31:00	6.96 pH	11.62 °C	1,284.6 µS/cm	0.20 mg/L	119.83 NTU	-64.8 mV	65.00 cm	30.00 ml/min
17/02/2022 11:33	31:30	6.95 pH	11.62 °C	1,286.0 µS/cm	0.20 mg/L	126.16 NTU	-64.5 mV	65.00 cm	30.00 ml/min
17/02/2022 11:33	32:00	6.95 pH	11.61 °C	1,290.4 µS/cm	0.20 mg/L	114.47 NTU	-64.3 mV	65.00 cm	30.00 ml/min
17/02/2022 11:34	32:30	6.95 pH	11.61 °C	1,290.3 µS/cm	0.20 mg/L	109.04 NTU	-64.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:34	33:00	6.95 pH	11.62 °C	1,292.0 µS/cm	0.20 mg/L	111.90 NTU	-64.4 mV	65.00 cm	30.00 ml/min
17/02/2022 11:35	33:30	6.95 pH	11.62 °C	1,291.9 µS/cm	0.20 mg/L	92.85 NTU	-64.1 mV	65.00 cm	30.00 ml/min
17/02/2022 11:35	34:00	6.95 pH	11.62 °C	1,290.9 µS/cm	0.20 mg/L	108.01 NTU	-63.9 mV	65.00 cm	30.00 ml/min

Samples

Sample ID:	Description:
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Low-Flow Test Report:

Test Date / Time: 17/02/2022 12:08:07
Project:
Operator Name:

Location Name: Bh101 Initial Depth to Water: 2.05 m	Estimated Total Volume Pumped: 90 ml Flow Cell Volume: 130 ml Final Flow Rate: 30 ml/min Final Draw Down: 0 m	Instrument Used: Aqua TROLL 500 Serial Number: 824599
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
17/02/2022 12:08	00:00	6.91 pH	12.28 °C	836.67 µS/cm	2.19 mg/L	799.87 NTU	86.9 mV	205.00 cm	30.00 ml/min
17/02/2022 12:08	00:30	6.92 pH	12.26 °C	836.57 µS/cm	2.15 mg/L	792.62 NTU	89.0 mV	205.00 cm	30.00 ml/min
17/02/2022 12:09	01:00	6.92 pH	12.28 °C	836.52 µS/cm	2.11 mg/L	783.34 NTU	91.0 mV	205.00 cm	30.00 ml/min
17/02/2022 12:09	01:30	6.92 pH	12.30 °C	836.17 µS/cm	2.07 mg/L	732.74 NTU	92.9 mV	205.00 cm	30.00 ml/min
17/02/2022 12:10	02:00	6.91 pH	12.33 °C	836.39 µS/cm	2.06 mg/L	736.75 NTU	94.5 mV	205.00 cm	30.00 ml/min
17/02/2022 12:10	02:30	6.91 pH	12.35 °C	836.44 µS/cm	2.08 mg/L	666.52 NTU	96.0 mV	205.00 cm	30.00 ml/min
17/02/2022 12:11	03:00	6.91 pH	12.34 °C	836.15 µS/cm	2.09 mg/L	617.53 NTU	97.4 mV	205.00 cm	30.00 ml/min

Samples

Sample ID:	Description:
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Low-Flow Test Report:

Test Date / Time: 17/02/2022 12:40:52
Project:
Operator Name:

Location Name: Bh101 a Initial Depth to Water: 1.85 m	Estimated Total Volume Pumped: 105 ml Flow Cell Volume: 130 ml Final Flow Rate: 30 ml/min Final Draw Down: 0 m	Instrument Used: Aqua TROLL 500 Serial Number: 824599
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
17/02/2022 12:40	00:00	10.15 pH	13.48 °C	1,348.2 µS/cm	1.79 mg/L	2.33 NTU	-34.6 mV	185.00 cm	30.00 ml/min
17/02/2022 12:41	00:30	10.16 pH	13.39 °C	1,348.4 µS/cm	1.43 mg/L	2.73 NTU	-36.0 mV	185.00 cm	30.00 ml/min
17/02/2022 12:41	01:00	10.17 pH	13.35 °C	1,348.7 µS/cm	1.26 mg/L	2.74 NTU	-37.0 mV	185.00 cm	30.00 ml/min
17/02/2022 12:42	01:30	10.17 pH	13.35 °C	1,348.7 µS/cm	1.22 mg/L	1.98 NTU	-37.4 mV	185.00 cm	30.00 ml/min
17/02/2022 12:42	02:00	10.17 pH	13.38 °C	1,349.2 µS/cm	1.16 mg/L	2.21 NTU	-37.8 mV	185.00 cm	30.00 ml/min
17/02/2022 12:43	02:30	10.17 pH	13.35 °C	1,348.6 µS/cm	1.14 mg/L	2.21 NTU	-37.9 mV	185.00 cm	30.00 ml/min
17/02/2022 12:43	03:00	10.17 pH	13.34 °C	1,348.3 µS/cm	1.13 mg/L	1.81 NTU	-37.9 mV	185.00 cm	30.00 ml/min
17/02/2022 12:44	03:30	10.17 pH	13.43 °C	1,349.8 µS/cm	1.09 mg/L	3.41 NTU	-38.1 mV	185.00 cm	30.00 ml/min

Samples

Sample ID:	Description:
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Low-Flow Test Report:

Test Date / Time: 17/02/2022 09:06:49
Project:
Operator Name:

Location Name: Bh102 Initial Depth to Water: 2.56 m	Estimated Total Volume Pumped: 851.667 ml Flow Cell Volume: 130 ml Final Flow Rate: 50 ml/min Final Draw Down: 0 m	Instrument Used: Aqua TROLL 500 Serial Number: 824599
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Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth to Water	Flow
		+/- 0.1	+/- 0.5	+/- 3 %	+/- 0.3	+/- 10	+/- 10	+/- 5	
17/02/2022 09:06	00:00	6.87 pH	11.26 °C	1,065.7 µS/cm	0.56 mg/L	625.65 NTU	216.2 mV	256.00 cm	50.00 ml/min
17/02/2022 09:07	01:02	6.88 pH	11.29 °C	1,060.6 µS/cm	0.49 mg/L	572.01 NTU	202.5 mV	256.00 cm	50.00 ml/min
17/02/2022 09:08	02:02	6.89 pH	11.35 °C	1,053.2 µS/cm	0.45 mg/L	514.63 NTU	196.4 mV	256.00 cm	50.00 ml/min
17/02/2022 09:09	03:02	6.88 pH	11.33 °C	1,048.9 µS/cm	0.42 mg/L	435.32 NTU	183.9 mV	256.00 cm	50.00 ml/min
17/02/2022 09:10	04:02	6.88 pH	11.22 °C	1,041.8 µS/cm	0.40 mg/L	387.26 NTU	175.6 mV	256.00 cm	50.00 ml/min
17/02/2022 09:11	05:02	6.89 pH	11.16 °C	1,039.3 µS/cm	0.39 mg/L	388.18 NTU	167.3 mV	256.00 cm	50.00 ml/min
17/02/2022 09:12	06:02	6.89 pH	11.19 °C	1,038.4 µS/cm	0.37 mg/L	378.03 NTU	167.8 mV	256.00 cm	50.00 ml/min
17/02/2022 09:13	07:02	6.89 pH	11.24 °C	1,036.0 µS/cm	0.36 mg/L	365.75 NTU	166.5 mV	256.00 cm	50.00 ml/min
17/02/2022 09:14	08:02	6.89 pH	11.29 °C	1,035.7 µS/cm	0.35 mg/L	337.51 NTU	155.5 mV	256.00 cm	50.00 ml/min
17/02/2022 09:15	09:02	6.89 pH	11.34 °C	1,031.7 µS/cm	0.35 mg/L	324.18 NTU	145.9 mV	256.00 cm	50.00 ml/min
17/02/2022 09:16	10:02	6.89 pH	11.28 °C	1,029.2 µS/cm	0.35 mg/L	315.96 NTU	145.1 mV	256.00 cm	50.00 ml/min
17/02/2022 09:17	11:02	6.89 pH	11.28 °C	1,027.3 µS/cm	0.35 mg/L	286.82 NTU	140.3 mV	256.00 cm	50.00 ml/min
17/02/2022 09:18	12:02	6.89 pH	11.23 °C	1,026.7 µS/cm	0.34 mg/L	260.49 NTU	141.3 mV	256.00 cm	50.00 ml/min
17/02/2022 09:19	13:02	6.89 pH	11.24 °C	1,020.6 µS/cm	0.34 mg/L	267.72 NTU	138.8 mV	256.00 cm	50.00 ml/min
17/02/2022 09:20	14:02	6.88 pH	11.26 °C	1,019.5 µS/cm	0.33 mg/L	244.51 NTU	127.3 mV	256.00 cm	50.00 ml/min
17/02/2022 09:21	15:02	6.89 pH	11.23 °C	1,020.2 µS/cm	0.31 mg/L	266.88 NTU	115.6 mV	256.00 cm	50.00 ml/min
17/02/2022 09:22	16:02	6.89 pH	11.22 °C	1,021.2 µS/cm	0.31 mg/L	253.42 NTU	112.7 mV	256.00 cm	50.00 ml/min

17/02/2022 09:23	17.02	6.89 pH	11.22 °C	1,026.0 µS/cm	0.30 mg/L	248.96 NTU	110.4 mV	256.00 cm	50.00 ml/min
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Samples

Sample ID:	Description:
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Created using VuSitu from In-Situ, Inc.

GAS MONITORING FIELD SHEET

Monitoring Date: 11/8/2/22		Measurement datum: GL / <u>Top of pipe</u> / Other		Offset to GL (m) 362 0.010m		Device: GAS3000		Serial Number		Daily Check							
Pre-Testing Remarks:				Air Temperature: 10 °C													
				Weather: Overcast													
				Ground Conditions: Wet													
Exploratory Position ID: WS205				Wind: NONE / LIGHT / MEDIUM / STRONG		Tidal State (if applicable): High / Low / Rising / Falling											
				Monitoring Round Number: 1		Test Number:											
Install Type: SINGLE / DOUBLE		Pipe Ref: 1) Shallow 2) Deep		Pipe Diameter: 19mm / 40mm / 50mm / Other 33 (mm)													
Test Sequence		Time of Monitoring		Gas Flow (l/hr)		Atmospheric Pressure (mb)		Differential Pressure (mb)		Gas tap: SINGLE / DOUBLE							
		hh:mm sec															
STAGE 1 Initial		8:06		0.00		1035		+0.07		Observations:							
Steady State		8:07		0.00		1035		-0.12									
STAGE 2 GAS CONCENTRATION READINGS		Time of Monitoring		Methane (%/vol)		Carbon Dioxide (%/vol)		Oxygen (%/vol)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		LEL (%)		PID (ppm)	
		hh:mm sec															
		8:08		0		0.0		0.1		20.8		0		0		0	
				15		1.1		0.1		19.9		0		19		1.8	
				30		1.5		0.1		17.4		0		20		2.1	
				60		1.7		0.1		16.6		0		20		2.4	
				90		1.6		0.1		16.5		1		19		2.7	
				120		1.6		0.1		16.5		1		19		2.9	
				180		1.5		0.1		16.6		1		16		3.1	
				240		1.5		0.2		16.6		1		12		3.0	
				300		1.5		0.2		16.7		1		11		3.0	
				360													
				420													
		480															
		540															
		600															
STAGE 3 WATER LEVEL OBSERVATION		Depth (from datum) to water: 1.280 (m)				Time:				LNAPL Top (from datum): (m)							
		Depth (from datum) to well base: 2.875 (m)								DNAPL Top (from datum): (m)							
		Hole Purged: Yes / No				Purge Start:											
		Purge Volume (l/s):				Purge End:											
Post Testing Remarks:						Samples Taken: Yes / No		Gas / Water									
						Depth (from datum)		Sample Ref		Type		Container					
										EW / G							
		Contract Name: Arundel Gas Works				Contract Ref: 29780				Date Collected By:							
		Project Manager / Engineer:				Page: of				Checked:							

GAS MONITORING FIELD SHEET

Monitoring Date: 11/2/22		Measurement datum: GL / <u>Top of pipe</u> / Other		Offset to GL (m): <u>0.010</u> ^{BGL}		Device: GASCOO		Serial Number:		Daily Check:	
Pre-Testing Remarks:				Air Temperature: 10 °C							
				Weather: Overcast							
				Ground Conditions: Wet							
Exploratory Position ID: WS206				Wind: NONE / <u>LIGHT</u> / MEDIUM / STRONG		Tidal State: (if applicable) High / Low / Rising / Falling					
				Monitoring Round Number: 1		Test Number:					
Install Type: <u>SINGLE</u> / DOUBLE		Pipe Ref: 1) Shallow 2) Deep		Pipe Diameter: 19mm / 40mm / 50mm / Other: <u>3</u> (mm)							
Test Sequence	Time of Monitoring		Gas Flow (l/hr)	Atmospheric Pressure (mb)	Differential Pressure (mb)	Gas tap: <u>SINGLE</u> / DOUBLE		Observations:			
	hh:mm	sec									
STAGE 1 GAS FLOW	Initial	8:17	0.0	1035	-0.25						
	Steady State	8:18	0.0	1035	-0.17						
STAGE 2 GAS CONCENTRATION READINGS	Time of Monitoring		Methane (%/vol)	Carbon Dioxide (%/vol)	Oxygen (%/vol)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	LEL (%)	PID (ppm)		
	hh:mm	sec									
	8:18	0	0.0	0.1	20.7	0	0		0		
		15	5.5	3.6	16.4	1	0		0.4		
		30	5.5	3.7	11.6	1	0		0.3		
		60	6.0	4.0	9.3	1	0		0.3		
		90	6.6	4.3	8.0	1	0		0.2		
		120	6.9	4.5	7.1	1	0		0.2		
		180	6.9	4.4	7.0	1	0		0.2		
		240	6.4	4.2	7.9	1	0		0.2		
		300	5.6	3.7	9.7	1	0		0.2		
		360	4.6	3.3	11.2	1	0		0.2		
		420	4.4	3.1	11.8	1	0		0.2		
	480	4.2	3.1	12.2	1	0		0.2			
	540	4.0	3.0	12.5	1	0		0.2			
	600	3.9	2.9	13.1	1	0		0.2			
STAGE 3 WATER LEVEL OBSERVATION	Depth (from datum) to water: 1.550 (m)		Time:		LNAPL Top (from datum): (m)						
	Depth (from datum) to well base: 1.955 (m)				DNAPL Top (from datum): (m)						
	Hole Purged: Yes / No		Purge Start:								
	Purge Volume: (lts)		Purge End:								
Post Testing Remarks:					Samples Taken: <u>Yes</u> / No		<u>Gas</u> / Water				
					Depth (from datum)	Sample Ref	Type	Container			
							EW / G				
					Contract Name: Arundel Gas Works		Contract Ref: 29780		By:		
					Project:		Page: 1 of 1		Checked:		

GAS MONITORING FIELD SHEET

Monitoring Date: 11/2/22		Measurement datum: GL / Top of pipe / Other		Offset to GL (m): 0.010m		Device: GAS000		Serial Number:		Daily Check:	
Pre-Testing Remarks:				Air Temperature: 10 °C							
				Weather: Clear							
				Ground Conditions: Wet							
Exploratory Position ID: WS 202				Wind: NONE / LIGHT / MEDIUM / STRONG		Tidal State: (if applicable)					
						High / Low / Rising / Falling					
Monitoring Round Number: 1				Test Number:							
Install Type: SINGLE / DOUBLE		Pipe Ref: 1) Shallow 2) Deep		Pipe Diameter: 19mm / 40mm / 50mm / Other: 33 (mm)							
Test Sequence	Time of Monitoring		Gas Flow (l/hr)	Atmospheric Pressure (mb)	Differential Pressure (mb)	Gas tap: SINGLE / DOUBLE		Observations:			
	hh:mm	sec									
STAGE 1 GAS FLOW	Initial	8:31	0.1	1035	-0.11						
	Steady State	8:32	0.2	1035	-0.09						
STAGE 2 GAS CONCENTRATION READINGS	Time of Monitoring		Methane (%/vol)	Carbon Dioxide (%/vol)	Oxygen (%/vol)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	LEL (%)	PID (ppm)		
	hh:mm	sec									
	8:32	0	0.0	0.1	20.7	0	0		0		
		15	0.1	0.4	18.2	0	5		3.8		
		30	0.1	0.4	16.2	0	5		4.3		
		60	0.1	0.5	14.9	0	7		4.9		
		90	0.3	0.6	12.2	1	9		5.6		
		120	0.3	0.6	11.1	1	10		5.8		
		180	0.4	0.6	9.4	1	11		6.5		
		240	0.5	0.7	8.0	1	12		7.3		
		300	0.5	0.7	7.6	1	12		7.7		
		360	0.5	0.7	7.5	1	12		7.5		
		420	0.5	0.7	7.8	1	12		7.7		
	480	0.5	0.7	7.6	1	12		7.9			
	540	0.5	0.6	7.4	1	12		8.4			
	600	0.5	0.6	7.2	1	12		8.6			
STAGE 3 WATER LEVEL OBSERVATION		Depth (from datum) to water: 2.830 (m)		Time:		LNAPL Top (from datum):		(m)			
		Depth (from datum) to well base: 2.910 (m)				DNAPL Top (from datum):		(m)			
		Hole Purged: Yes / No		Purge Start:							
		Purge Volume: (l/s)		Purge End:							
Post Testing Remarks:						Samples Taken: Yes / No		Gas / Water			
						Depth (from datum)	Sample Ref	Type	Container		
								EW / G			
Contract Name: Arundel Gas Works		Contract Ref: 29780		D:							
		Project Manager / Engineer:		Page: of		Checked:					

GAS MONITORING FIELD SHEET

Monitoring Date: 11/2/22		Measurement datum: GL / Top of pipe / Other: GL		Offset to AGL GL (m) 0.020m		Device: GA5000		Serial Number		Daily Check	
Pre-Testing Remarks:				Air Temperature: 11 °C							
				Weather: Overcast							
				Ground Conditions: Wet							
Exploratory Position ID: WS 201				Wind: NONE / HIGH / MEDIUM / STRONG		Tidal State: (if applicable) High / Low / Rising / Falling					
Monitoring Round Number:				Test Number:							
Install Type: SINGLE / DOUBLE		Pipe Ref: 1) Shallow 2) Deep		Pipe Diameter: 19mm / 40mm / 50mm / Other: 33 (mm)							
Test Sequence	Time of Monitoring		Gas Flow (l/hr)	Atmospheric Pressure (mb)	Differential Pressure (mb)	Gas tap: SINGLE / DOUBLE		Observations:			
	hh:mm	sec									
STAGE 1 GAS FLOW	Initial	8:44	0.1	1035	-0.09						
	Steady State	8:45	0.2	1035	-0.11						
STAGE 2 GAS CONCENTRATION READINGS	Time of Monitoring		Methane (%/vol)	Carbon Dioxide (%/vol)	Oxygen (%/vol)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	LEL (%)	PID (ppm)		
	hh:mm	sec									
	8:46	0	0.0	0.1	21.0	0	0		0.0		
	:	15	0.0	0.1	9.5	0	13		325.1		
	:	30	0.0	0.0	2.3	0	16		480.2		
	:	60	0.0	0.0	0.8	0	20		569.3		
	:	90	0.0	0.0	0.3	0	23		688.1		
	:	120	0.0	0.0	0.2	0	24		732.5		
	:	180	0.1	0.0	0.1	0	27		808.9		
	:	240	0.1	0.0	0.2	0	29		827.6		
	:	300	0.1	0.0	0.2	0	30		851.7		
	:	360									
	:	420									
:	480										
:	540										
:	600										
STAGE 3 WATER LEVEL OBSERVATION		Depth (from datum) to water: DRY (m)		Time:		LNAPL Top (from datum):		(m)			
		Depth (from datum) to well base: 1.960 (m)				DNAPL Top (from datum):		(m)			
		Hole Purged: Yes / No		Purge Start:							
		Purge Volume: (lts)		Purge End:							
Post Testing Remarks:						Samples Taken: Yes / No		Gas / Water			
						Depth (from datum)	Sample Ref	Type	Container		
								EW / G			
Contract Name: Arundel Gas Works		Contract Ref: 29780		Data Collected By:							
		Project Manager / Engineer:		Page: of							

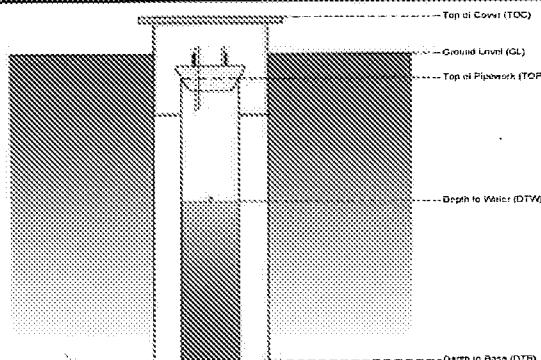
GAS MONITORING FIELD SHEET

Monitoring Date: 11/2/22		Measurement datum: GL <u>Top of pipe</u> / Other		Offset to GL (m) <u>AGL</u> 0.010m		Device: GASCOO		Serial Number:		Daily Check							
Pre-Testing Remarks:				Air Temperature: 11 °C													
				Weather: Overcast													
				Ground Conditions: Wet													
Exploratory Position ID: WS203				Wind: NONE / <u>LIGHT</u> / MEDIUM / STRONG		Tidal State (if applicable) High / Low / Rising / Falling											
Install Type: <u>SINGLE</u> DOUBLE				Pipe Ref: 1) Shallow 2) Deep		Pipe Diameter: 19mm / 40mm / 50mm / <u>Other</u> 33 (mm)											
Test Sequence		Time of Monitoring hh:mm sec		Gas Flow (l/hr)		Atmospheric Pressure (mb)		Differential Pressure (mb)		Gas tap: <u>SINGLE</u> / DOUBLE							
STAGE 1 GAS FLOW		Initial 8:53		0.0		1035		-0.12		Observations:							
		Steady State 8:54		0.0		1035		-0.11									
STAGE 2 GAS CONCENTRATION READINGS		Time of Monitoring hh:mm sec		Methane (%/vol)		Carbon Dioxide (%/vol)		Oxygen (%/vol)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		LEL (%)		PID (ppm)	
		8:54		0		0.0		0.1		20.9		0		0		0	
		:		15		0.4		3.6		16.7		0		27		158.7	
		:		30		0.4		3.6		12.3		0		29		127.5	
		:		60		0.4		3.9		11.0		0		29		104.3	
		:		90		0.5		4.6		8.7		0		28		83.3	
		:		120		0.7		5.6		6.1		0		28		71.7	
		:		180		0.8		6.5		2.9		0		28		57.9	
		:		240		0.8		6.4		2.7		0		26		48.9	
		:		300		0.7		6.2		3.0		0		24		41.2	
		:		360		0.7		5.8		4.1		0		22		37.0	
		:		420		0.6		5.3		5.9		0		19		32.8	
		:		480		0.5		5.0		7.4		0		17		29.7	
		:		540		0.4		4.5		9.3		0		15		27.8	
:		600		0.3		4.1		11.0		0		13		25.7			
STAGE 3 WATER LEVEL OBSERVATION		Depth (from datum) to water: 0.84 (m)				Time:				LNAPL Top (from datum):				(m)			
		Depth (from datum) to well base: 2.910 (m)								DNAPL Top (from datum):				(m)			
		Hole Purged: Yes / No				Purge Start:											
		Purge Volume: (lts)				Purge End:											
Post Testing Remarks:						Samples Taken: <u>Yes</u> / No		<u>Gas</u> / Water									
						Depth (from datum)		Sample Ref		Type		Container					
										EW / G							
Contract Name: Arundel Gas Works Project Manager / Engineer: [REDACTED]						Contract Ref: 29780		Data Collected By: [REDACTED]									
						Page: [REDACTED] of [REDACTED]											



Groundwater Sampling Data Form

Project Information	Project Name:		Arundel Gas Works		
	Project Number:		29780		
	Sampling Date:		11/2/22	Sampled by: [REDACTED]	
	Weather:		Overcast ~10°C		
	Well Notes - e.g. Condition, access, safety:				
Monitoring Information	Water Quality Meter Used:		-		
	Water Quality Meter Last Calibrated:		-		
	Dissolved oxygen probe last calibrated:		-		
	Water Level Meter Used (tick applicable):				
	Interface probe		Dip Meter	Coolestech	
	Typical Parameter Stabilisation Criteria for Low-Flow Sampling		Dissolved Oxygen (D.O.)		0.3 mg/l
			Specific Conductivity (Sp.Cond)		3%
p.H			0.1 unit		
Oxygen Reduction Potential (ORP)			10mV		
* For REDOX correction, see separate guidance					



Well location		BH102									
Measurement datum:		Notes: Tick the measurement datum used below and always include the offset to ground level. If ticked 'Ground Level', the offset to GL will be 0m. See figure above for definitions									
Top of Cover (TOC)		Ground Level (GL)			Top of Pipework (TOP) (m)		✓	Offset from TOC to GL (m)		0.040m BGL	
Purge Start Time:	7 58	Time (HH:MM)	Temp (°C)	Sp.Cond (µS/cm)	D.O. (mg/l)	pH (units)	ORP (mV)	Depth to Water (m)	Corr. REDOX (mV)*	Notes / Flow (ml/min)	
Well Diameter (mm)										dark brown no colour opaque, high sediment	
Well Material											
Static Water Level (m)	1.730										
LNAPL Present?	Y N										
LNAPL Level (m)											
Well Headspace Reading (PID/FID)											
Purge Method	Low Flow Other:										
Sampling Method	Peristaltic Bladder Other:										
Pump Intake Depth (m)	12.000	Sampling Notes (e.g. oil/colour/odour), Reasons if not monitored					Purge only. 50L purged.				
Depth to Base (m)	12.540										
DNAPL Present?	Y N	Sample Containers Obtained					0				
DNAPL Level (m)		Sample Collection Time									

APPENDIX F

LABORATORY CERTIFICATES FOR SOIL ANALYSIS



Andrew Tranter
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i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS



Analytical Report Number : 22-38841

Project / Site name:	Arundel Gas Works	Samples received on:	09/02/2022
Your job number:	29780	Samples instructed on/ Analysis started on:	10/02/2022
Your order number:		Analysis completed by:	25/02/2022
Report Issue Number:	1	Report issued on:	25/02/2022
Samples Analysed:	6 soil samples		

Signed



Karolina Marek
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-38841
Project / Site name: Arundel Gas Works

Lab Sample Number				2168209	2168210	2168211	2168212	2168213
Sample Reference				WS201	WS202	WS203	WS204	WS205
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.50	0.45	0.50	0.65
Date Sampled				07/02/2022	07/02/2022	07/02/2022	07/02/2022	07/02/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	11	12	14	12
Total mass of sample received	kg	0.001	NONE	1.2	1.1	1.1	1.1	1.2

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Chrysotile- Loose Fibres	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	NTK	NTK	NTK	NTK	NTK

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	10.3	9.4	7.7	8.2
Total Cyanide	mg/kg	1	MCERTS	91	11	20	-	1.1
Free Cyanide	mg/kg	1	MCERTS	1.1	< 1.0	< 1.0	-	< 1.0
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	1.0	-	0.66	0.037
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	1010	-	662	37.2
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	150	-	4.6	8.3
Ammoniacal Nitrogen as N	mg/kg	0.5	MCERTS	6.0	8.2	12	-	2.4
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	< 2.0	-	< 2.0	< 2.0

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	1.3	< 1.0	-	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	72	3.1	0.36	0.28
Acenaphthylene	mg/kg	0.05	MCERTS	11	27	5.3	2.7	0.56
Acenaphthene	mg/kg	0.05	MCERTS	0.96	39	1.7	0.49	< 0.05
Fluorene	mg/kg	0.05	MCERTS	3.3	86	4.2	1.2	0.34
Phenanthrene	mg/kg	0.05	MCERTS	26	440	34	13	4.2
Anthracene	mg/kg	0.05	MCERTS	11	170	11	3.3	0.81
Fluoranthene	mg/kg	0.05	MCERTS	65	440	65	26	7.3
Pyrene	mg/kg	0.05	MCERTS	62	380	56	30	5.8
Benzo(a)anthracene	mg/kg	0.05	MCERTS	49	260	40	16	4.2
Chrysene	mg/kg	0.05	MCERTS	30	210	29	11	3.2
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	46	220	33	12	4.8
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	22	77	21	6.0	2.0
Benzo(a)pyrene	mg/kg	0.05	MCERTS	38	180	33	10	3.8
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	23	73	16	6.2	2.0
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	7.0	24	5.5	1.9	0.77
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	23	65	17	6.6	2.0

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	417	2760	375	147	42.1
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Analytical Report Number: 22-38841
Project / Site name: Arundel Gas Works

Lab Sample Number				2168209	2168210	2168211	2168212	2168213
Sample Reference				WS201	WS202	WS203	WS204	WS205
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.50	0.45	0.50	0.65
Date Sampled				07/02/2022	07/02/2022	07/02/2022	07/02/2022	07/02/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	20	21	21	18	19
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	6.4	4.4	0.7	0.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	23	32	25	21	25
Copper (aqua regia extractable)	mg/kg	1	MCERTS	64	49	31	35	31
Lead (aqua regia extractable)	mg/kg	1	MCERTS	460	140	130	190	140
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	0.9
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	26	21	17	26
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	180	140	140	88	80
Magnesium (water soluble)	mg/kg	5	NONE	-	7.3	-	22	< 5.0
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	3.6	-	11	< 2.5
Monocaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	340	42	< 1.0	-	< 1.0
Toluene	µg/kg	1	MCERTS	59	35	< 1.0	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	7.2	8.3	< 1.0	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	51	82	< 1.0	-	< 1.0
o-xylene	µg/kg	1	MCERTS	22	50	< 1.0	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6 _{HS, 1D, AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8 _{HS, 1D, AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10 _{HS, 1D, AL}	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12 _{EH, CU, 1D, AL}	mg/kg	1	MCERTS	1.5	17	< 1.0	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH, CU, 1D, AL}	mg/kg	2	MCERTS	16	50	4.5	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 _{EH, CU, 1D, AL}	mg/kg	8	MCERTS	24	70	14	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 _{EH, CU, 1D, AL}	mg/kg	8	MCERTS	49	260	18	-	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35) _{EH, CU+HS, 1D, AL}	mg/kg	10	MCERTS	91	390	36	-	< 10
TPH-CWG - Aromatic >EC5 - EC7 _{HS, 1D, AR}	mg/kg	0.001	MCERTS	0.34	0.042	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8 _{HS, 1D, AR}	mg/kg	0.001	MCERTS	0.059	0.035	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10 _{HS, 1D, AR}	mg/kg	0.001	MCERTS	0.097	0.30	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12 _{EH, CU, 1D, AR}	mg/kg	1	MCERTS	3.0	100	9.4	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH, CU, 1D, AR}	mg/kg	2	MCERTS	30	490	41	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 _{EH, CU, 1D, AR}	mg/kg	10	MCERTS	250	2300	150	-	23
TPH-CWG - Aromatic >EC21 - EC35 _{EH, CU, 1D, AR}	mg/kg	10	MCERTS	360	2300	180	-	34
TPH-CWG - Aromatic (EC5 - EC35) _{EH, CU+HS, 1D, AR}	mg/kg	10	MCERTS	640	5100	380	-	57

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-38841
Project / Site name: Arundel Gas Works

Lab Sample Number				2168214
Sample Reference				WS206
Sample Number				None Supplied
Depth (m)				0.50
Date Sampled				07/02/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	13
Total mass of sample received	kg	0.001	NONE	1.2

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	NTK

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.0
Total Cyanide	mg/kg	1	MCERTS	-
Free Cyanide	mg/kg	1	MCERTS	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.027
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	27.0
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	8.7
Ammoniacal Nitrogen as N	mg/kg	0.5	MCERTS	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.63
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.36
Phenanthrene	mg/kg	0.05	MCERTS	3.2
Anthracene	mg/kg	0.05	MCERTS	1.1
Fluoranthene	mg/kg	0.05	MCERTS	8.4
Pyrene	mg/kg	0.05	MCERTS	7.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	5.3
Chrysene	mg/kg	0.05	MCERTS	3.6
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	5.1
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	2.3
Benzo(a)pyrene	mg/kg	0.05	MCERTS	4.4
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.5
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.76
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.6

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	47.4
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Analytical Report Number: 22-38841
Project / Site name: Arundel Gas Works

Lab Sample Number				2168214
Sample Reference				WS206
Sample Number				None Supplied
Depth (m)				0.50
Date Sampled				07/02/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Heavy Metals / Metalloids				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16
Boron (water soluble)	mg/kg	0.2	MCERTS	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	27
Copper (aqua regia extractable)	mg/kg	1	MCERTS	23
Lead (aqua regia extractable)	mg/kg	1	MCERTS	69
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	72
Magnesium (water soluble)				
Magnesium (water soluble)	mg/kg	5	NONE	6.6
Magnesium (leachate equivalent)	mg/l	2.5	NONE	3.3

Monocaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	-
Toluene	µg/kg	1	MCERTS	-
Ethylbenzene	µg/kg	1	MCERTS	-
p & m-xylene	µg/kg	1	MCERTS	-
o-xylene	µg/kg	1	MCERTS	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	MCERTS	-
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	MCERTS	-
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	MCERTS	-
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	-
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	-
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	-
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	-
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	MCERTS	-

TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	MCERTS	-
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	MCERTS	-
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	MCERTS	-
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	-
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	-
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	-
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	-
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	MCERTS	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-38841

Project / Site name: Arundel Gas Works

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2168209	WS201	None Supplied	0.4	Brown clay and sand with gravel and chalk.
2168210	WS202	None Supplied	0.5	Brown loam and sand with gravel and clinker
2168211	WS203	None Supplied	0.45	Brown clay and loam with gravel and vegetation.
2168212	WS204	None Supplied	0.5	Brown clay and sand with gravel.
2168213	WS205	None Supplied	0.65	Brown clay and sand with gravel.
2168214	WS206	None Supplied	0.5	Brown clay and sand with gravel.

Analytical Report Number : 22-38841
Project / Site name: Arundel Gas Works

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Ammoniacal Nitrogen as N in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method,10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS

Analytical Report Number : 22-38841
Project / Site name: Arundel Gas Works

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym/Operator	Description
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
~	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

APPENDIX F1

LABORATORY CERTIFICATES FOR BITUMEN SAMPLE



Analytical Report Number: 22-40748
Project / Site name: Arundel Gas Works

Lab Sample Number				2178985
Sample Reference				Tarmac
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				17/02/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	0.31
Total mass of sample received	kg	0.001	NONE	1.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	2.7
Acenaphthylene	mg/kg	0.05	MCERTS	6.5
Acenaphthene	mg/kg	0.05	MCERTS	78
Fluorene	mg/kg	0.05	MCERTS	89
Phenanthrene	mg/kg	0.05	MCERTS	830
Anthracene	mg/kg	0.05	MCERTS	210
Fluoranthene	mg/kg	0.05	MCERTS	1100
Pyrene	mg/kg	0.05	MCERTS	760
Benzo(a)anthracene	mg/kg	0.05	MCERTS	560
Chrysene	mg/kg	0.05	MCERTS	350
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	700
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	620
Benzo(a)pyrene	mg/kg	0.05	MCERTS	330
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	210
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	25
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	200

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	6080
-----------------------------	-------	-----	--------	------

Miscellaneous Organics

Coal Tar		N/A	NONE	Not Identified
Total Residue	mg/kg	10	NONE	11000

U/S = Unsuitable Sample I/S = Insufficient Sample

APPENDIX G

LABORATORY CERTIFICATES FOR GEOTECHNICAL ANALYSIS



STRUCTURAL SOILS LTD

TEST REPORT



Report No. 584776-01 (00)

1774

Date 07-March-2022 Contract Arundel Gas Works

Client RSK
Address 18 Frogmore Rd
Apsley
Hemel Hempstead
Hertfordshire
HP3 9RT

For the Attention of Andrew Tranter

Samples submitted by client	14-February-2022	Client Reference	29780
Testing Started	15-February-2022	Client Order No.	n/a
Testing Completed	03-March-2022	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

- | | |
|-------|--|
| 1.01 | Moisture Content (oven drying method) BS1377:Part 2:1990:clause 3.2 (superseded)* |
| 1.03 | Liquid Limit (one point method) & Plastic Limit BS1377:Part 2:1990,clause 4.4/5.3 (superseded)* |
| 10.02 | Saturated moisture content of chalk BS1377:Part 2:1990,clause 3.3 |

Undertaken by subcontractor

- | | |
|------|---|
| 2.07 | pH value in accordance with BRE Special Digest 1:2005 |
| 2.04 | Sulphate content (water extract) in accordance with BRE Special Digest 1:2005 |

* This clause of BS1377 is no longer the most up to date method due to the publication of ISO17892

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of .
Test were undertaken on samples 'as received' unless otherwise stated.

Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd 18 Frogmore Rd Hemel Hempstead HP3 9RT Tel.01442 416661 e-mail dimitris.xirouchakis@soils.co.uk

TESTING VERIFICATION CERTIFICATE



1774

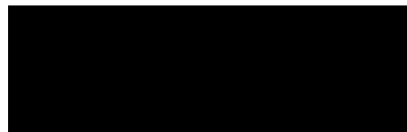
The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **02/03/2022 14:12:05**.

Testing reported after this date is not covered by this Verification Certificate.



Approved Signatory
Sharon Cairns (Laboratory Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU



**STRUCTURAL
SOILS LTD**

Contract:

Arundel Gas Works

Job No:

584776



SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with Part 1, Part 12 of BS EN ISO 17892

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Water Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425um	Description of Sample
BH101		D	6.00	26.2	30	23	7	51	Off-white sandy gravelly structureless CHALK. Gravel is chalk
BH102		D	1.00	19.6	51	26	25	56	Brown mottled dark brown, dark grey and white slightly sandy gravelly CLAY. Gravel is chalk and flint
BH102		D	2.75	14.8	61	25	36	48	Brown mottled orange slightly sandy gravelly CLAY
BH102		D	4.75	14.0	61	26	35	21	Brown gravelly silty SAND
BH102		D	9.00	27.2	30	22	8	39	Light brown mottled off-white sandy gravelly CHALK. Gravel is chalk and flint

SYMBOLS: * denotes BS 1377



**STRUCTURAL
SOILS LTD**

Contract:

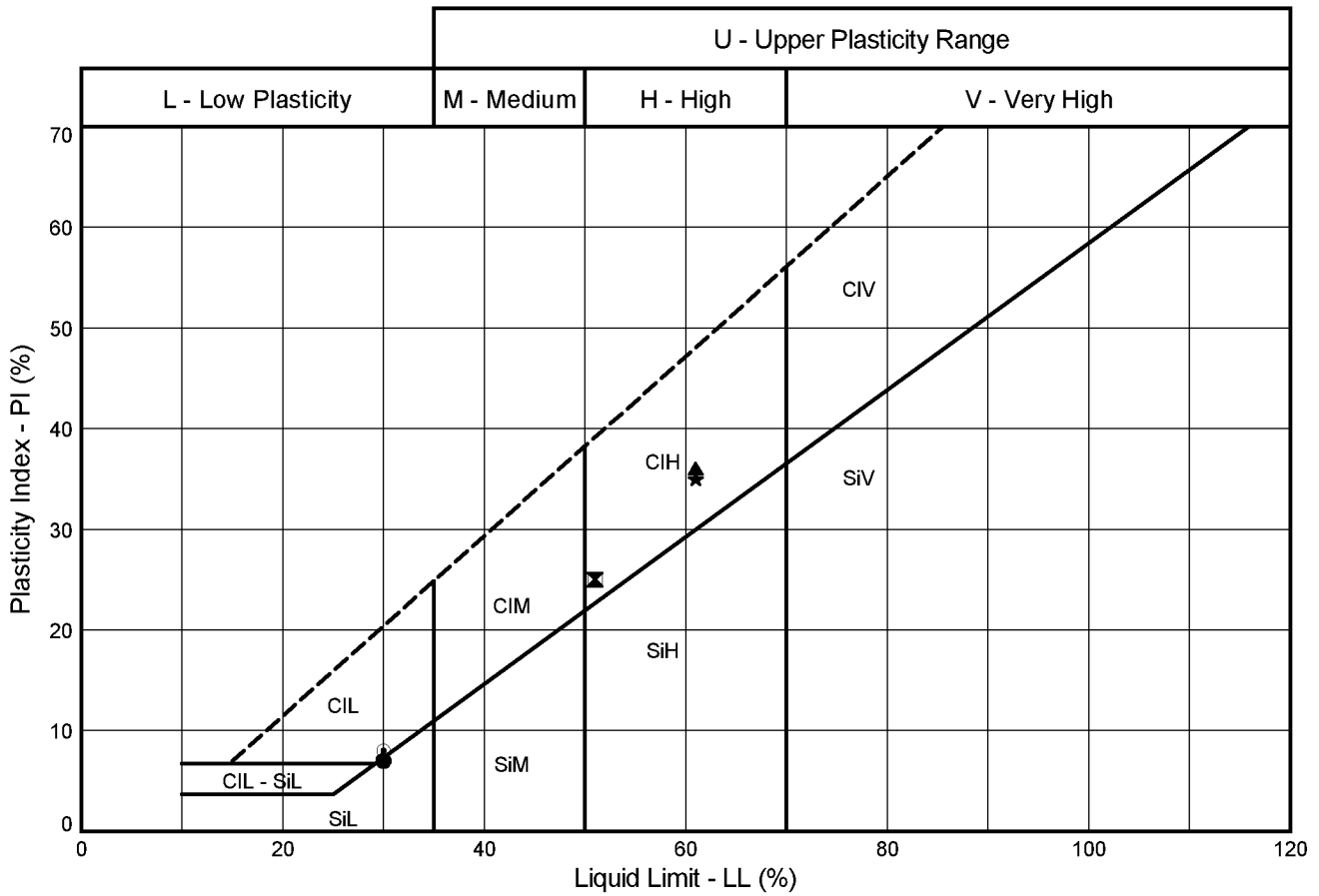
Arundel Gas Works

Contract Ref:

584776



According to BS EN 14688-2:2018
Testing in accordance with BS EN ISO 17892-12:2018+A1:2021

[illegible]

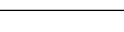
Tested in accordance with the following clauses of BS EN ISO 17892-12:2018+A1:2021
5.3 - Cone Penetrometer Method; 5.3.14 - One-Point Cone Penetrometer Method; 5.4 - Casagrande Method; 5.5 - Plastic Limit Method; 6.5 - Plasticity Index

Water Content (WC) tested in accordance with BS EN ISO 17892-1:2014

+ Tested in accordance with the following clauses of BS EN ISO 17892-12:2018+A1:2021
5.2.1 - Natural State and 5.2.7 - Wet Sieved

Key: * = Non-standard test, NP = Non plastic, I = Increasing WC, D = Decreasing WC.

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)

 STRUCTURAL SOILS 18 Frogmore Road Hemel Hempstead Hertfordshire HP3 9RT	Compiled By		Date
		SHARON CAIRNS	02/03/22
	Contract	Contract Ref:	
	Arundel Gas Works	584776	

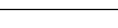
SUMMARY OF SATURATED MOISTURE CONTENT OF CHALK TESTS

In accordance with clause 3.3 of BS1377:Part 2:1990

[illegible]

* denotes the average values from multiple lumps

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)

 STRUCTURAL SOILS 18 Frogmore Road Hemel Hempstead Hertfordshire HP3 9RT	Compiled By		Date	Contract Ref: 584776 
		SHARON CAIRNS	02.03.22	
	Contract: Arundel Gas Works			

FINAL ANALYTICAL TEST REPORT

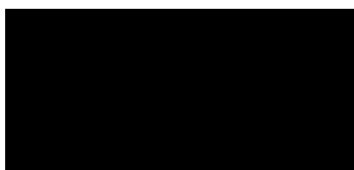
Envirolab Job Number: 22/01491
Issue Number: 1

Date: 23 February, 2022

Client: RSK Environment Ltd Hemel
18 Frogmore Road
Hemel Hempstead
Hertfordshire
UK
HP3 9RT

Project Manager: Hemel Lab/Max Battle
Project Name: Arundel Gas Works
Project Ref: 29780
Order No: N/A
Date Samples Received: 18/02/22
Date Instructions Received: 18/02/22
Date Analysis Completed: 23/02/22

Approved by:



Sophie France
Client Service Manager

Envirolab Job Number: 22/01491

Client Project Name: Arundel Gas Works

Client Project Ref: 29780

Lab Sample ID	22/01491/1	22/01491/2	22/01491/3	22/01491/4				Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH102	BH102	BH102	BH102						
Depth to Top	1.00	2.75	4.75	9.00						
Depth To Bottom										
Date Sampled										
Sample Type	Soil - D	Soil - D	Soil - D	Solid						
Sample Matrix Code	6AE	5A	5A	7						
% Stones >10mm _A	6.0	15.5	30.1	<0.1				% w/w	0.1	A-T-044
pH BRE _D ^{M#}	7.90	8.55	9.00	8.78				pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1) _D ^{M#}	631	118	64	41				mg/l	10	A-T-026s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

v2

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR

Client: RSK Environment Ltd Hemel, 18 Frogmore Road, Hemel Hempstead,
Hertfordshire, UK, HP3 9RT

Project: Arundel Gas Works

Clients Project No: 29780

Project No: 22/01491

Date Received: 18/02/2022 (am)

Cool Box Temperatures (°C): 5.1

Lab Sample ID	22/01491/1	22/01491/2	22/01491/3	22/01491/4
Client Sample No				
Client Sample ID/Depth	BH102 1.00m	BH102 2.75m	BH102 4.75m	BH102 9.00m
Date Sampled				
Deviation Code				
E (no date)	✓	✓	✓	✓

Key

E (no date) No sampling date provided (all results affected if not provided)

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/01491/1	22/01491/2	22/01491/3	22/01491/4
Client Sample No				
Client Sample ID/Depth	BH102 1.00m	BH102 2.75m	BH102 4.75m	BH102 9.00m
Date Sampled				
A-T-026s	23/02/2022	23/02/2022	23/02/2022	23/02/2022
A-T-031s	23/02/2022	23/02/2022	23/02/2022	23/02/2022
A-T-044	23/02/2022	23/02/2022	23/02/2022	23/02/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

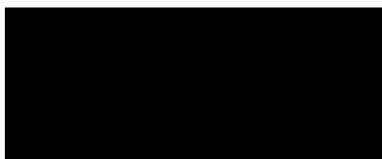
FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 22/01762
Issue Number: 1
Date: 03 March, 2022

Client: RSK Environment Ltd Hemel
18 Frogmore Road
Hemel Hempstead
Hertfordshire
UK
HP3 9RT

Project Manager: Hemel Lab/Max Battle
Project Name: Arundel Gas Works
Project Ref: 584776
Order No: N/A
Date Samples Received: 25/02/22
Date Instructions Received: 25/02/22
Date Analysis Completed: 03/03/22

Approved by:



Sophie France
Client Service Manager

Envirolab Job Number: 22/01762

Client Project Name: Arundel Gas Works

Client Project Ref: 584776

Lab Sample ID	22/01762/1	22/01762/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH102	BH102								
Depth to Top	15.00	22.50								
Depth To Bottom										
Date Sampled										
Sample Type	Solid	Solid								
Sample Matrix Code	7	7								
% Stones >10mm _A	<0.1	<0.1						% w/w	0.1	A-T-044
pH BRE _D ^{M#}	9.13	8.46						pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1) _D ^{M#}	63	339						mg/l	10	A-T-026s

REPORT NOTES

General

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Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

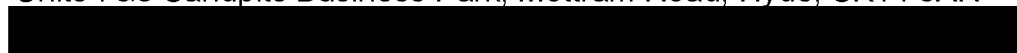
Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

v2

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR



Client: RSK Environment Ltd Hemel, 18 Frogmore Road, Hemel Hempstead,
Hertfordshire, UK, HP3 9RT

Project: Arundel Gas Works

Clients Project No: 584776

Project No: 22/01762

Date Received: 25/02/2022 (am)

Cool Box Temperatures (°C): 7.4

Lab Sample ID	22/01762/1	22/01762/2
Client Sample No		
Client Sample ID/Depth	BH102 15.00m	BH102 22.50m
Date Sampled		
Deviation Code		
E (no date)	✓	✓

Key

E (no date) No sampling date provided (all results affected if not provided)

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

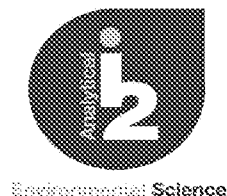
Lab Sample ID	22/01762/1	22/01762/2
Client Sample No		
Client Sample ID/Depth	BH102 15.00m	BH102 22.50m
Date Sampled		
A-T-026s	03/03/2022	03/03/2022
A-T-031s	03/03/2022	03/03/2022
A-T-044	02/03/2022	02/03/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

APPENDIX H

LABORATORY CERTIFICATES FOR GROUNDWATER ANALYSIS



Andrew Tranter
RSK Stats Ltd
18
Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

t: 01442 437500
f: 01442 437550
e: ATranter@rsk.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS



Analytical Report Number : 22-40748

Project / Site name:	Arundel Gas Works	Samples received on:	17/02/2022
Your job number:	29780	Samples instructed on/ Analysis started on:	18/02/2022
Your order number:		Analysis completed by:	04/03/2022
Report Issue Number:	1	Report issued on:	04/03/2022
Samples Analysed:	1 soil sample - 5 water samples		

Signed:

Karolina Marek
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-40748
Project / Site name: Arundel Gas Works

Lab Sample Number				2178985
Sample Reference				Tarmac
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				17/02/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Acceptation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	0.31
Total mass of sample received	kg	0.001	NONE	1.0

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	2.7
Acenaphthylene	mg/kg	0.05	MCERTS	6.5
Acenaphthene	mg/kg	0.05	MCERTS	78
Fluorene	mg/kg	0.05	MCERTS	89
Phenanthrene	mg/kg	0.05	MCERTS	830
Anthracene	mg/kg	0.05	MCERTS	210
Fluoranthene	mg/kg	0.05	MCERTS	1100
Pyrene	mg/kg	0.05	MCERTS	760
Benzo(a)anthracene	mg/kg	0.05	MCERTS	560
Chrysene	mg/kg	0.05	MCERTS	350
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	700
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	620
Benzo(a)pyrene	mg/kg	0.05	MCERTS	330
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	210
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	25
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	200

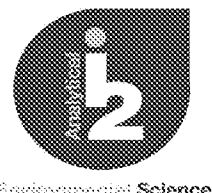
Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	6080
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Miscellaneous Organics

Coal Tar		N/A	NONE	Not Identified
Total Residue	mg/kg	10	NONE	11000

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 22-40748
Project / Site name: Arundel Gas Works

Lab Sample Number				2178980	2178981	2178982	2178983	2178984
Sample Reference				BH101	BH101A	BH102	BH104	BH105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

General Inorganics

pH	pH Units	N/A	ISO 17025	7.4	9.8	7.5	7.9	-
Total Cyanide	µg/l	10	ISO 17025	< 10	1000	120	29	-
Sulphate as SO ₄	µg/l	45	ISO 17025	35300	473000	130000	78400	-
Sulphate as SO ₄	mg/l	0.045	ISO 17025	35.3	473	130	78.4	-
Ammoniacal Nitrogen as N	µg/l	15	ISO 17025	< 15	200000	810	< 15	-

Hardness - Total	mgCaCO ₃ /l	1	ISO 17025	350	238	403	144	-
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Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	16000	< 10	130	-
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	745	< 0.01	< 0.01	-
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	28.7	< 0.01	< 0.01	-
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	6.97	< 0.01	< 0.01	-
Fluorene	µg/l	0.01	ISO 17025	< 0.01	12.0	< 0.01	< 0.01	-
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	-

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	793	< 0.16	< 0.16	-
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Heavy Metals / Metalloids

Boron (dissolved)	µg/l	10	ISO 17025	64	240	100	87	170
Calcium (dissolved)	mg/l	0.012	ISO 17025	130	94	140	43	-
Magnesium (dissolved)	mg/l	0.005	ISO 17025	6.8	0.47	11	8.6	-

Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.98	24.4	1.51	0.63	3.23
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.03	0.15	< 0.02	0.03	< 0.02
Chromium (dissolved)	µg/l	0.2	ISO 17025	2.1	1.0	2.3	1.4	1.7
Copper (dissolved)	µg/l	0.5	ISO 17025	2.7	3.3	1.4	1.7	3.5
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	0.7	< 0.2	< 0.2	< 0.2
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	0.13	< 0.05	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	3.9	98	20	1.6	9.5
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.8	17	1.8	0.8	0.8
Zinc (dissolved)	µg/l	0.5	ISO 17025	8.2	5.9	6.4	4.7	7.1



Analytical Report Number: 22-40748
Project / Site name: Arundel Gas Works

Lab Sample Number				2178980	2178981	2178982	2178983	2178984
Sample Reference				BH101	BH101A	BH102	BH104	BH105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

Monosomatics & Oxygenates

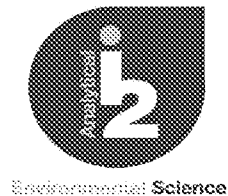
Benzene	µg/l	1	ISO 17025	< 1.0	1040	< 1.0	< 1.0	-
Toluene	µg/l	1	ISO 17025	< 1.0	228	< 1.0	< 1.0	-
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	-
p & m-xylene	µg/l	1	ISO 17025	< 1.0	27.1	< 1.0	< 1.0	-
o-xylene	µg/l	1	ISO 17025	< 1.0	20.5	< 1.0	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >C5 - C6 HS_ID_AL	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	-
TPH-CWG - Aliphatic >C6 - C8 HS_ID_AL	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	-
TPH-CWG - Aliphatic >C8 - C10 HS_ID_AL	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	-
TPH-CWG - Aliphatic >C10 - C12 EH_ID_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	-
TPH-CWG - Aliphatic >C12 - C16 EH_ID_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	-
TPH-CWG - Aliphatic >C16 - C21 EH_ID_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	-
TPH-CWG - Aliphatic >C21 - C35 EH_ID_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	-
TPH-CWG - Aliphatic (C5 - C35) HS+EH_ID_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	-

TPH-CWG - Aromatic >C5 - C7 HS_ID_AR	µg/l	1	ISO 17025	< 1.0	1000	< 1.0	< 1.0	-
TPH-CWG - Aromatic >C7 - C8 HS_ID_AR	µg/l	1	ISO 17025	< 1.0	230	< 1.0	< 1.0	-
TPH-CWG - Aromatic >C8 - C10 HS_ID_AR	µg/l	1	ISO 17025	< 1.0	48	< 1.0	< 1.0	-
TPH-CWG - Aromatic >C10 - C12 EH_ID_AR_#1_#2_MS	µg/l	10	NONE	< 10	1400	< 10	< 10	-
TPH-CWG - Aromatic >C12 - C16 EH_ID_AR_#1_#2_MS	µg/l	10	NONE	< 10	7000	< 10	< 10	-
TPH-CWG - Aromatic >C16 - C21 EH_ID_AR_#1_#2_MS	µg/l	10	NONE	< 10	7500	< 10	< 10	-
TPH-CWG - Aromatic >C21 - C35 EH_ID_AR_#1_#2_MS	µg/l	10	NONE	< 10	1400	< 10	< 10	-
TPH-CWG - Aromatic (C5 - C35) HS+EH_ID_AR_#1_#2_MS	µg/l	10	NONE	< 10	19000	< 10	< 10	-

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 22-40748
Project / Site name: Arundel Gas Works

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2178985	Tarmac	None Supplied	None Supplied	Grey gravel with tar.

Analytical Report Number : 22-40748
Project / Site name: Arundel Gas Works

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
Total Hardness of water	Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
pH at 20oC in water	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L005-PL	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025

Analytical Report Number : 22-40748
Project / Site name: Arundel Gas Works

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammoniacal Nitrogen as N in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Coal Tar in Soil	DCM Extraction with qualitative interpretation via GC/MS	In-house method	L064-PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Description
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Sample Deviation Report

Analytical Report Number : 22-40748

Project / Site name: Arundel Gas Works

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
BH101	None Supplied	W	2178980	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH101	None Supplied	W	2178980	c	pH at 20oC in water	L005-PL	c
BH101A	None Supplied	W	2178981	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH101A	None Supplied	W	2178981	c	pH at 20oC in water	L005-PL	c
BH102	None Supplied	W	2178982	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH102	None Supplied	W	2178982	c	pH at 20oC in water	L005-PL	c
BH104	None Supplied	W	2178983	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH104	None Supplied	W	2178983	c	pH at 20oC in water	L005-PL	c
Tarmac	None Supplied	S	2178985	b	Coal Tar in Soil	L064-PL	b
Tarmac	None Supplied	S	2178985	b	Speciated EPA-16 PAHs in soil	L064-PL	b

APPENDIX I

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH

Generic assessment criteria for human health: residential scenario without home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009⁽¹⁾. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009⁽²⁾. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)^(3,4), as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)⁽⁵⁾ used in the generation of SGVs.

C4SL were initially published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010⁽³⁾). Further C4SL were published in 2021 for vinyl chloride, tetrachloroethene (PCE) and trichloroethene (TCE). Where a C4SL has been published, the RSK GAC duplicates the C4SL using all input parameters within the SP1010 final project report⁽³⁾ and associated chemical specific reports⁽⁶⁾, and adopts them as GAC for these substances. Due to the use of decimal places rather than significant figures applied to the Contaminated Land Exposure Assessment (CLEA) tool outputs, the GAC presented may be marginally differently to the C4SL values, however any differences between the values are minimal and would not equate to an unacceptable risk.

For all other substances the C4SL exposure modifications relevant for residential without home-grown produce end use have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) and reducing exposure frequency for dermal contact outdoors.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015⁽⁷⁾ or by the USEPA⁽¹⁴⁾, where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the CLEA tool v1.071, supporting EA guidance^(5,8,9) and revised exposure scenarios published for the C4SL⁽³⁾. The SAC are also termed GAC.

Conceptual model

In accordance with SR3⁽⁵⁾, the residential without home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In

accordance with Box 3.1 of SR3⁽⁵⁾, the pathways considered for production of the SAC in the residential without home-grown produce scenario are

- direct soil and dust ingestion in areas of soft landscaping
- dermal contact with soil and indoor dust
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium⁽¹⁾, the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh} , are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase⁽⁹⁾. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached⁽⁹⁾. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required⁽⁹⁾:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook⁽⁹⁾, this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook⁽⁹⁾, which explains how to calculate an effective assessment criterion manually.

SR3⁽⁵⁾ states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7⁽¹⁰⁾, the EA TOX⁽¹⁾ reports, the C4SL SP1010 project report and associated chemical specific reports^(3,6), the 2015 LQM/CIEH report⁽⁷⁾ or the USEPA IRIS database⁽¹⁴⁾. Where a LLTC^(3,6) has been published for a substance, RSK has used these input parameters to derive the RSK GAC. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report⁽¹¹⁾.

For TPH, aromatic hydrocarbons C₅–C₈ were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential without home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. SR3⁽⁵⁾ notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3⁽³⁾, with a dust loading factor detailed in Section 9.3 of SR3⁽⁵⁾. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3⁽⁵⁾. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3⁽⁵⁾ input parameters for residential without home-grown produce

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3⁽⁵⁾. Modifications to the default SR3⁽⁵⁾ exposure scenarios based on the C4SL exposure scenarios⁽³⁾ are presented in Table 2 below.

The final selected GAC are presented by pathway in Table 3 and the combined GAC in Table 4.

Figure 1: Conceptual model for CLEA residential scenario without home-grown produce

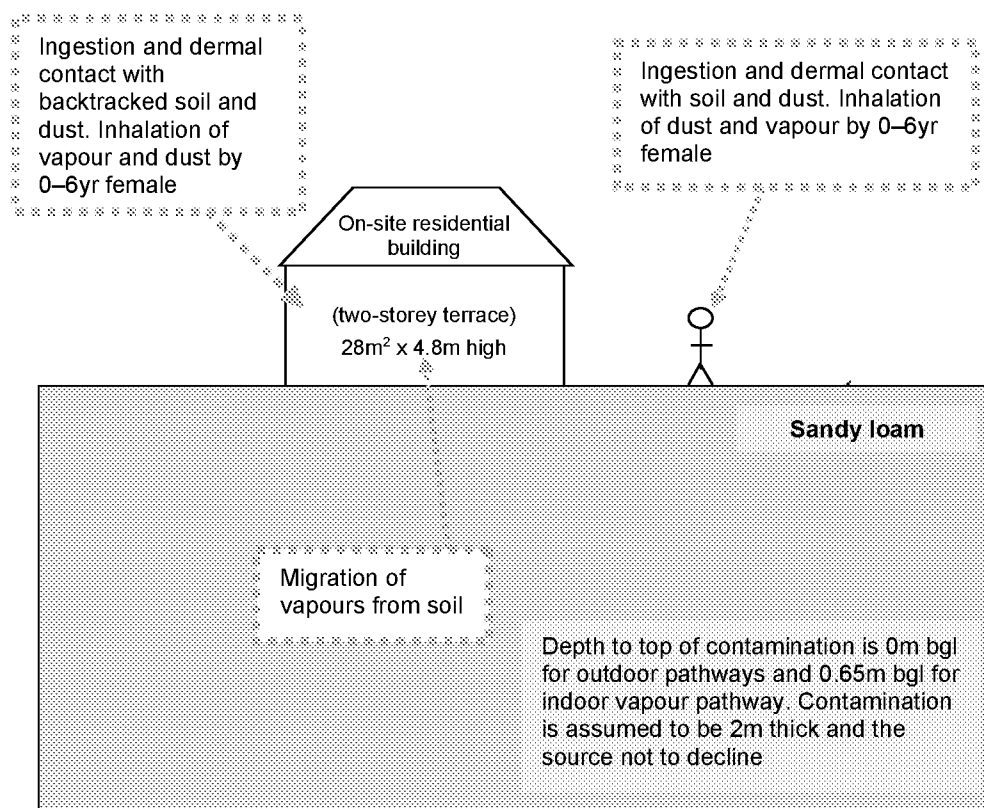


Table 1: Exposure assessment parameters for residential scenario without home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential without home-grown produce	Chosen land use
Receptor	Female child	Key generic assumption given in Box 3.1, SR3 ⁽⁵⁾
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3 ⁽⁵⁾ . Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3) ⁽⁵⁾
Soil type	Sandy loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3) ⁽⁵⁾
Start age class (AC)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3 ⁽⁵⁾
End AC	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents' ⁽¹³⁾
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential without home-grown produce – modified receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
Soil to skin adherence factor – (outdoor)	mg soil/cm ² skin	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010 ⁽³⁾					
Inhalation rate	m ³ day ⁻¹	5.4	8.0	8.9	10.1	10.1	10.1
Justification		Mean value USEPA, 2011 ⁽¹²⁾ ; Table 3.2, SP1010 ⁽³⁾					
Notes: For cadmium , the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI _{oral} and TDI _{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3 ⁽¹⁾ , Science Report SC050021/Cadmium SGV ⁽¹⁾ and the project report SP1010 ⁽³⁾ for more information.							

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GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE



Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR
Barium	(b)	1.36E+03	NR	NR	NR	1.36E+03	NR	NR	NR	1.36E+03	NR	NR	NR
Beryllium		1.56E+02	1.72E+00	NR	NR	1.56E+02	1.72E+00	NR	NR	1.56E+02	1.72E+00	NR	NR
Boron		1.08E+04	5.20E+06	NR	NR	1.08E+04	5.20E+06	NR	NR	1.08E+04	5.20E+06	NR	NR
Cadmium	(a)	1.95E+02	4.68E+02	1.49E+02	NR	1.95E+02	4.68E+02	1.49E+02	NR	1.95E+02	4.68E+02	1.49E+02	NR
Chromium (III) - trivalent	(c)	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR
Chromium (VI) - hexavalent	(a,d)	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR
Copper		1.09E+04	1.41E+04	7.13E+03	NR	1.09E+04	1.41E+04	7.13E+03	NR	1.09E+04	1.41E+04	7.13E+03	NR
Lead	(a)	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR
Elemental Mercury (Hg ⁰)	(d)	NR	2.41E-01	NR	4.31E+00	NR	5.74E-01	NR	1.07E+01	NR	1.25E+00	NR	2.58E+01
Inorganic Mercury (Hg ²⁺)		5.71E+01	3.83E+03	5.82E+01	NR	5.71E+01	3.83E+03	5.82E+01	NR	5.71E+01	3.83E+03	5.82E+01	NR
Methyl Mercury (Hg ⁴⁺)		1.80E+01	1.87E+01	8.19E+00	7.33E+01	1.80E+01	3.62E+01	1.20E+01	1.42E+02	1.80E+01	7.89E+01	1.46E+01	3.04E+02
Nickel	(d)	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR
Selenium	(b)	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR
Vanadium		1.17E+03	1.46E+03	NR	NR	1.17E+03	1.46E+03	NR	NR	1.17E+03	1.46E+03	NR	NR
Zinc	(b)	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR
Cyanide (free)		4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR
Volatile Organic Compounds													
Benzene	(a)	7.28E+01	9.01E-01	8.90E-01	1.22E+03	7.36E+01	1.68E+00	1.64E+00	2.26E+03	7.36E+01	3.46E+00	3.23E+00	4.71E+03
Toluene		2.87E+04	9.08E+02	8.80E+02	8.69E+02	2.87E+04	2.00E+03	1.87E+03	1.92E+03	2.87E+04	4.55E+03	3.93E+03	4.36E+03
Ethylbenzene		1.29E+04	8.34E+01	8.29E+01	5.18E+02	1.29E+04	1.98E+02	1.83E+02	1.22E+03	1.29E+04	4.96E+02	4.42E+02	2.84E+03
Xylene - m		2.32E+04	8.29E+01	8.22E+01	6.25E+02	2.32E+04	1.95E+02	1.83E+02	1.47E+03	2.32E+04	4.59E+02	4.47E+02	3.46E+03
Xylene - o		2.32E+04	8.87E+01	8.83E+01	4.78E+02	2.32E+04	2.08E+02	2.06E+02	1.12E+03	2.32E+04	4.86E+02	4.79E+02	2.62E+03
Xylene - p		2.32E+04	7.93E+01	7.80E+01	5.76E+02	2.32E+04	1.86E+02	1.85E+02	1.35E+03	2.32E+04	4.36E+02	4.28E+02	3.17E+03
Total xylene		2.32E+04	7.93E+01	7.80E+01	6.25E+02	2.32E+04	1.96E+02	1.85E+02	1.47E+03	2.32E+04	4.36E+02	4.28E+02	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		3.87E+04	1.04E+02	1.04E+02	2.04E+04	3.87E+04	1.89E+02	1.89E+02	3.31E+04	3.87E+04	3.21E+02	3.19E+02	6.27E+04
Trichloroethene (TCE)		9.73E-03	3.61E-02	NR	1.54E+03	2.04E-02	7.57E-02	NR	3.22E+03	4.52E-02	1.68E-01	NR	7.14E+03
Tetrachloroethene (PCE)		1.80E+03	3.19E-01	3.19E-01	4.24E+02	1.80E+03	7.15E-01	7.16E-01	9.51E+02	1.80E+03	1.64E+00	1.64E+00	2.18E+03
1,1,1-Trichloroethane		7.74E+04	9.01E+00	9.01E+00	1.43E+03	7.74E+04	1.84E+01	1.84E+01	2.92E+03	7.74E+04	4.04E+01	4.04E+01	6.39E+03
1,1,1,2-Tetrachloroethane		7.34E+02	1.54E+00	1.53E+00	2.60E+03	7.34E+02	3.56E+00	3.55E+00	6.02E+03	7.34E+02	8.29E+00	8.20E+00	1.40E+04
1,1,2,2-Tetrachloroethane		7.34E+02	3.92E+00	3.90E+00	2.67E+03	7.34E+02	8.04E+00	7.95E+00	5.46E+03	7.34E+02	1.76E+01	1.72E+01	1.20E+04
Carbon Tetrachloride		5.15E+02	2.58E-02	2.58E-02	1.52E+03	5.15E+02	5.65E-02	5.64E-02	3.32E+03	5.15E+02	1.28E-01	1.28E-01	7.54E+03
1,2-Dichloroethane		1.55E+01	9.20E-03	9.20E-03	3.41E+03	1.55E+01	1.33E-02	1.29E-02	4.91E+03	1.55E+01	2.28E-02	2.27E-02	8.43E+03
Vinyl Chloride (chloroethene)		4.86E+00	1.47E-02	1.47E-02	1.36E+03	4.86E+00	1.80E-02	1.80E-02	1.76E+03	4.86E+00	2.91E-02	2.89E-02	2.69E+03
1,2,4-Trimethylbenzene		NR	5.68E+00	NR	4.74E+02	NR	1.29E+01	NR	1.16E+03	NR	2.69E+01	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
Semi-Volatile Organic Compounds													
Acenaphthene		7.64E+03	4.86E+04	6.60E+03	5.70E+01	7.64E+03	1.18E+05	7.17E+03	1.41E+02	7.64E+03	2.88E+05	7.43E+03	3.36E+02
Acenaphthylene		7.65E+03	4.59E+04	6.55E+03	8.61E+01	7.65E+03	1.11E+05	7.15E+03	2.12E+02	7.65E+03	2.53E+05	7.42E+03	5.06E+02
Anthracene		3.82E+04	1.53E+05	3.06E+04	1.17E+00	3.82E+04	3.77E+05	3.47E+04	2.91E+00	3.82E+04	8.76E+05	3.66E+04	6.96E+00
Benzo(a)anthracene		1.98E+01	2.47E+01	1.10E+01	1.71E+00	1.98E+01	4.37E+01	1.36E+01	4.28E+00	1.98E+01	6.26E+01	1.50E+01	1.03E+01
Benzo(a)pyrene	(a)	5.34E+00	3.51E+01	NR	9.11E-01	5.34E+00	3.77E+01	NR	2.28E+00	5.34E+00	3.89E+01	NR	5.46E+00
Benzo(b)fluoranthene		4.97E+00	1.93E+01	3.95E+00	1.22E+00	4.97E+00	2.13E+01	4.03E+00	3.04E+00	4.97E+00	2.22E+01	4.06E+00	7.29E+00
Benzo(g,h,i)perylene		4.38E+02	1.87E+03	3.55E+02	1.54E-02	4.38E+02	1.94E+03	3.58E+02	3.85E-02	4.38E+02	1.97E+03	3.59E+02	9.23E-02
Benzo(k)fluoranthene		1.31E+02	5.41E+02	1.06E+02	6.87E-01	1.31E+02	5.76E+02	1.07E+02	1.72E+00	1.31E+02	5.91E+02	1.07E+02	4.12E+00
Chrysene		3.95E+01	1.19E+02	2.97E+01	4.40E-01	3.95E+01	1.49E+02	3.12E+01	1.10E+00	3.95E+01	1.66E+02	3.19E+01	2.64E+00

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE



Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Dibenzo(a,h)anthracene		3.95E-01	1.45E+00	3.10E-01	3.93E-03	3.95E-01	1.64E+00	3.18E-01	9.82E-03	3.95E-01	1.74E+00	3.22E-01	2.36E-02
Fluoranthene		1.59E+03	3.83E+04	1.53E+03	1.89E+01	1.59E+03	8.87E+04	1.58E+03	4.73E+01	1.59E+03	1.83E+05	1.58E+03	1.13E+02
Fluorene		5.09E+03	6.20E+03	2.80E+03	3.09E+01	5.09E+03	1.53E+04	3.82E+03	7.65E+01	5.09E+03	3.62E+04	4.47E+03	1.83E+02
Indeno(1,2,3-cd)pyrene		5.65E+01	2.12E+02	4.46E+01	6.13E-02	5.65E+01	2.39E+02	4.56E+01	1.53E-01	5.65E+01	2.50E+02	4.60E+01	3.68E-01
Naphthalene		2.50E+03	2.33E+01	2.31E+01	7.64E+01	2.50E+03	5.58E+01	5.40E+01	1.83E+02	2.50E+03	1.31E+02	1.25E+02	4.32E+02
Phenanthrene		1.58E+03	7.17E+03	1.30E+03	3.60E+01	1.58E+03	1.76E+04	1.45E+03	8.96E+01	1.58E+03	4.07E+04	1.52E+03	2.14E+02
Pyrene		3.82E+03	8.79E+04	3.66E+03	2.20E+00	3.82E+03	2.04E+05	3.75E+03	5.49E+00	3.82E+03	4.23E+05	3.79E+03	1.32E+01
Phenol		6.48E+04	4.98E+02	4.95E+02	2.42E+04	6.48E+04	6.95E+02	6.88E+02	3.81E+04	6.48E+04	1.19E+03	1.17E+03	7.03E+04
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC ₅ -EC ₆		3.23E+05	4.24E+01	4.24E+01	3.04E+02	3.23E+05	7.79E+01	7.79E+01	5.58E+02	3.23E+05	1.81E+02	1.81E+02	1.15E+03
Aliphatic hydrocarbons >EC ₆ -EC ₉		3.23E+05	1.04E+02	1.04E+02	1.44E+02	3.23E+05	2.31E+02	2.31E+02	3.22E+02	3.23E+05	5.29E+02	5.29E+02	7.36E+02
Aliphatic hydrocarbons >EC ₉ -EC ₁₀		6.45E+03	2.66E+01	2.66E+01	7.77E+01	6.45E+03	6.59E+01	6.59E+01	1.90E+02	6.45E+03	1.56E+02	1.55E+02	4.51E+02
Aliphatic hydrocarbons >EC ₁₀ -EC ₁₂		6.45E+03	1.33E+02	1.32E+02	4.75E+01	6.45E+03	3.31E+02	3.27E+02	1.18E+02	6.45E+03	7.93E+02	7.67E+02	2.83E+02
Aliphatic hydrocarbons >EC ₁₂ -EC ₁₆		6.45E+03	1.11E+03	1.06E+03	2.37E+01	6.45E+03	2.78E+03	2.42E+03	5.91E+01	6.45E+03	6.67E+03	4.37E+03	1.42E+02
Aliphatic hydrocarbons >EC ₁₆ -EC ₃₅	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC ₃₅ -EC ₄₄	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC ₉ -EC ₁₀		2.58E+03	4.74E+01	4.72E+01	6.13E+02	2.58E+03	1.18E+02	1.15E+02	1.50E+03	2.58E+03	2.77E+02	2.69E+02	3.58E+03
Aromatic hydrocarbons >EC ₁₀ -EC ₁₂		2.58E+03	2.52E+02	2.52E+02	3.64E+02	2.58E+03	8.29E+02	5.94E+02	8.99E+02	2.58E+03	1.52E+03	1.24E+03	2.15E+03
Aromatic hydrocarbons >EC ₁₂ -EC ₁₆		2.58E+03	2.85E+03	1.80E+03	1.69E+02	2.58E+03	7.07E+03	2.30E+03	4.19E+02	2.58E+03	1.68E+04	2.48E+03	1.00E+03
Aromatic hydrocarbons >EC ₁₆ -EC ₂₁	(b)	1.86E+03	NR	NR	5.37E+01	1.90E+03	NR	NR	1.34E+02	1.82E+03	NR	NR	3.21E+02
Aromatic hydrocarbons >EC ₂₁ -EC ₃₅	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC ₃₅ -EC ₄₄	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. GRAC - groundwater assessment criteria. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

	Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.
	Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.
	Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs naphthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for boron and selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE			
Table 4 Human health generic assessment criteria for residential without home-grown produce			
RSK			
Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	40	40	40
Barium	1,300	1,300	1,300
Beryllium	1.7	1.7	1.7
Boron	11,000	11,000	11,000
Cadmium	149	149	149
Chromium (III) - trivalent	910	910	910
Chromium (VI) - hexavalent	21	21	21
Copper	7,100	7,100	7,100
Lead	310	310	310
Elemental Mercury (Hg ⁰)	0.2	0.6	1.2
Inorganic Mercury (Hg ²⁺)	56	56	56
Methyl Mercury (Hg ⁴⁺)	9	12	15
Nickel	180	180	180
Selenium	430	430	430
Vanadium	1,200	1,200	1,200
Zinc	40,000	40,000	40,000
Cyanide (free)	40	40	40
Volatile Organic Compounds			
Benzene	0.9	1.6	3.3
Toluene	900 (869)	1,900	3,900
Ethylbenzene	80	190	440
Xylene - m	80	190	450
Xylene - o	90	210	480
Xylene - p	80	180	430
Total xylene	80	180	430
Methyl tertiary-Butyl ether (MTBE)	100	170	320
Trichloroethene (TCE)	0.010	0.020	0.045
Tetrachloroethene (PCE)	0.32	0.71	1.64
1,1,1-Trichloroethane	9.0	18.4	40.4
1,1,1,2 Tetrachloroethane	1.5	3.5	8.2
1,1,2,2-Tetrachloroethane	3.9	8.0	17.2
Carbon Tetrachloride	0.026	0.056	0.128
1,2-Dichloroethane	0.009	0.013	0.023
Vinyl Chloride (chloroethene)	0.015	0.019	0.029
1,2,4-Trimethylbenzene	5.6	12.9	26.9
1,3,5-Trimethylbenzene	NR	NR	NR
Semi-Volatile Organic Compounds			
Acenaphthene	6,600 (57)	7,200	7,400
Acenaphthylene	6,600 (86)	7,200	7,400
Anthracene	31,000 (1.17)	35,000	37,000
Benzo(a)anthracene	11.0	13.6	15.0
Benzo(a)pyrene	5.3	5.3	5.3
Benzo(b)fluoranthene	4.0	4.0	4.1
Benzo(g,h,i)perylene	355	358	359
Benzo(k)fluoranthene	106	107	107
Chrysene	30	31	32
Dibenzo(a,h)anthracene	0.31	0.32	0.32
Fluoranthene	1,500	1,600	1,600
Fluorene	2,800 (31)	3,800 (77)	4,500 (183)
Indeno(1,2,3-cd)pyrene	45	46	46
Naphthalene	23	55	125
Phenanthrene	1,300 (36)	1,450	1,520
Pyrene	3,700	3,800	3,800
Phenol	440*	688	1,170
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC ₅ -EC ₆	42	78	161
Aliphatic hydrocarbons >EC ₆ -EC ₈	100	230	530
Aliphatic hydrocarbons >EC ₈ -EC ₁₀	27	65	155
Aliphatic hydrocarbons >EC ₁₀ -EC ₁₂	130 (48)	330 (118)	770 (283)
Aliphatic hydrocarbons >EC ₁₂ -EC ₁₆	1,100 (24)	2,400 (59)	4,400 (142)
Aliphatic hydrocarbons >EC ₁₆ -EC ₃₅	65,000 (8)	92,000 (21)	111,000
Aliphatic hydrocarbons >EC ₃₅ -EC ₄₄	65,000 (8)	92,000 (21)	111,000
Aromatic hydrocarbons >EC ₈ -EC ₁₀	47	115	269
Aromatic hydrocarbons >EC ₁₀ -EC ₁₂	300	600	1,200
Aromatic hydrocarbons >EC ₁₂ -EC ₁₆	1,800 (169)	2,300 (419)	2,500
Aromatic hydrocarbons >EC ₁₆ -EC ₂₁	1,900	1,900	1,900
Aromatic hydrocarbons >EC ₂₁ -EC ₃₅	1,900	1,900	1,900
Aromatic hydrocarbons >EC ₃₅ -EC ₄₄	1,900	1,900	1,900
Minerals			
Asbestos	Stage 1 test – No asbestos detected with ID; Stage 2 test - <0.001% dry weight (exceedance of either equates to an exceedance of the GAC) ¹		
Notes: ¹ - Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data. NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used EC - equivalent carbon. SAC - soil assessment criteria. ¹ LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry. The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994. SAC for TPH fractions, PAHs naphthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3. (VALUE IN BRACKETS) RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.			

APPENDIX J

GENERIC ASSESSMENT CRITERIA FOR VAPOURS

Generic assessment criteria (vGAC) for indoor human health exposure

Background

RSK's vapour generic assessment criteria (vGAC) were initially prepared in 2012. The RSK vGAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

The potential for volatile organic compounds (VOC) present in the ground to cause significant human health risks *via* inhalation exposure is well documented and UK guidance on investigating, assessing and managing risks of inhalation of VOC on land affected by contamination has been published in CIRIA C682⁽¹⁾. CIRIA C682⁽¹⁾ is consistent with existing UK regulatory guidance on land contamination (e.g. the CLEA model and supporting documents^(2,3,4) and complements BS8576⁽⁵⁾ - Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs).

A detailed framework for the assessment of VOC is provided in CIRIA C682⁽¹⁾, which describes the development and use of screening criteria for VOC present in soil, groundwater and soil gas (vapour).

For soil it is recognised that for VOC, published Soil Guideline Values (SGV) or calculated generic assessment criteria (GAC) that include, or are specific to, indoor inhalation exposure pathways may be used as conservative screening criteria⁽¹⁾. RSK has calculated GAC for VOC in soils for a variety of end-uses using CLEA v1.06, where SGV are not available. RSK also uses data from the Suitable for Use Levels published in 2015 by Nathaniel et al.,⁽⁶⁾ and CL:AIRE⁽⁷⁾. For groundwater, RSK has calculated GAC using the RBCA model (version 1.3b) updated to reflect UK guidance.

It is recognised within CIRIA C682⁽¹⁾ that SGV/GAC for VOC in soil and groundwater calculated using published coefficients to estimate the partitioning from the sorbed or dissolved phase into the gas phase (e.g. Henry's constant) may be conservative by up to several orders of magnitude. Additional conservatism of inhalation exposure may also occur through estimation of soil gas intrusion into building *via* the foundation using models such as Johnson & Ettinger (J&E)⁽⁸⁾, although there are recognisable differences between chlorinated and non-chlorinated compounds. The J&E model is known to typically overestimate the intrusion of non-chlorinated VOC into buildings, whilst chlorinated VOC may be underestimated, with the consequence that the J&E model is no longer recommended for predicting vapour intrusion of chlorinated VOC in many of the states in the USA⁽¹⁾. This difference is in part due to the often rapid biodegradation of non-chlorinated VOC and very slow degradation of chlorinated in aerobic environments such as those typically found in shallow soils and beneath buildings.

Notwithstanding the above, it should be recognised that comparison of laboratory data for VOC in soils with SGV/GAC may also underestimate inhalation risk, due to the potential loss of VOC during soil sampling, which may be significant. Many states in the USA disregard reliance on soil results for vapour intrusion assessment for this reason.

The conservatism associated with estimating the indoor intrusion of VOC in soils has been recognised in guidance for the use of the CLEA model⁽³⁾, where calculated indoor VOC concentrations may be amended using a sub-surface soil to indoor air correction factor for petroleum hydrocarbons.

In general, multiple lines of evidence are recommended for vapour intrusion risk assessment⁽¹⁾. However, **it is not necessary to undertake soil gas VOC monitoring at all sites**, particularly those where VOC are not anticipated or identified in soil and groundwater. In deciding when it is appropriate to undertake soil gas VOC monitoring the following situations should be considered, based on a detailed understanding of the conceptual model and possible limitations in your data:

- Reliance on VOC in soil data alone - acceptable only where shallow groundwater is absent and where:
 - VOC sources are not anticipated;
 - VOC are not identified during drilling/sampling (i.e. no olfactory evidence); and
 - VOC concentrations in soil samples are representative and well below SGV/GAC; potential significant losses of VOC during soil sampling must be recognised.
- Reliance on VOC in soil and groundwater data alone (i.e. no soil gas VOC data) - acceptable only where:
 - VOC sources are not anticipated;
 - VOC are not identified during drilling/sampling (i.e. no olfactory evidence); and
 - VOC concentrations in soil and groundwater samples are representative and below SGV/GAC; potential significant losses of VOC during soil sampling must be recognised.

Where VOC are either anticipated or present in soil and/or groundwater in concentrations near to or exceeding SGV/GAC then direct measurement of VOC in soil gas is recommended to assess potential inhalation exposure. Soil gas VOC data should initially be compared with generic soil gas VOC assessment criteria (vGAC).

Remediation measures should not be recommended, or remediation criteria calculated, to mitigate inhalation exposure risks in the absence of soil gas VOC data, except in specific circumstances, e.g. where acute risk is possible or emergency response work is being undertaken.

Generic Soil Gas VOC Assessment Criteria (vGAC)

As part of a multiple lines of evidence approach, recommended in CIRIA C682, RSK details herein the calculation of vGAC to be used for screening soil gas VOC concentrations for the protection of human health inhalation exposure within residential and commercial buildings. vGAC are relevant to soil gas VOC concentrations measured in the following scenarios:

- Open spaces, with planned future development;
- Near slab – i.e. close to, but outside, the building footprint; and
- Sub slab – i.e. directly beneath the building footprint.

It is important to note that vGAC relate to soil gas concentrations only and are not for use when assessing the results of indoor air sampling. Indoor air sampling data must be compared directly with relevant published or adjusted inhalation health criteria value (HCV) such as those in Table 3 or with occupational exposure limits depending upon the purpose of the assessment.

Model Selection

In line with recommendations⁽⁹⁾ and the approach taken within the CLEA model, RSK has used the J&E model⁽¹⁰⁾ as the basis to estimate the vGAC. Limitations of the J&E model for chlorinated compounds are noted. The following components of vapour intrusion are incorporated within the model:

1. Partitioning of contaminants between groundwater, soil and vapour-phase.
2. Movement of contaminants in the soil vapour-phase through the unsaturated zone – **diffusion** controlled.
3. Movement of contaminants in the soil vapour-phase through the unsaturated zone – **advection** controlled for shallow soils beneath a building.
4. Movement of contaminants through the building foundation (dust-filled joints and cracks) - **advection** controlled.
5. Dilution of soil gas vapours within indoor air.

Movement of soil gas vapours through advection forces (pressure differential) is recognised to be more rapid than *via* diffusion, particularly in close proximity to building foundations.

The following components of vapour intrusion are not included in the model:

1. Preferential flow paths through foundations (e.g. *via* large cracks or service entries);
2. Biodegradation/bioattenuation during unsaturated zone transport, during intrusion via the foundation or whilst in indoor air.

The output of the J&E model is the calculation of an attenuation factor (α) by the following equation (Equation 10.4 in SR3⁽³⁾):

$$\alpha = \frac{\left[\frac{D_{eff} A_E}{Q_b L_T} \exp \left(\frac{Q_s L_{crack}}{D_{crack} A_{crack}} \right) \right]}{\left[\exp \left(\frac{Q_s L_{crack}}{D_{crack} A_{crack}} \right) + \frac{D_{eff} A_E}{Q_b L_T} + \frac{D_{eff} A_E}{Q_s L_T} \left[\exp \left(\frac{Q_s L_{crack}}{D_{crack} A_{crack}} \right) - 1 \right] \right]}$$

Where: α is the steady-state attenuation coefficient between soil and indoor air, dimensionless
 D_{eff} is the effective diffusion coefficient for unsaturated soils, $\text{cm}^2 \text{s}^{-1}$
 A_E is the area of enclosed floor and walls below ground, cm^2
 Q_b is the building ventilation rate, $\text{cm}^3 \text{s}^{-1}$
 L_T is the source-building separation, cm
 Q_s is the volumetric flow rate of soil gas into the enclosed space, $\text{cm}^3 \text{s}^{-1}$ [25 to 150]
 L_{crack} is the foundation slab thickness, cm
 A_{crack} is the floor crack area, cm^2
 D_{crack} is the effective diffusion coefficient through the cracks, $\text{cm}^2 \text{s}^{-1}$ [= D_{eff}]
 Note: Appendix 1, Equation A10 where the Peclet number approaches infinity

The attenuation factor (α) is the ratio of the indoor concentration to the concentration in the soil gas for a particular chemical (Equation 10.6 in SR3⁽³⁾) and is a measure of the degree of **reduction** in concentration as VOC migrate into buildings:

$$A = \left[\frac{D_{eff}}{E_B \left(\frac{V_B}{A_B} \right) L_T} \right] \quad B = \left[\frac{\left(\frac{Q_{soil}}{Q_B} \right) E_B \left(\frac{V_B}{A_B} \right) L_{crack}}{D_{crack} \eta} \right] \quad C = \left[\frac{Q_{soil}}{Q_B} \right]$$

Identification of critical parameters for the J&E model (1991) was undertaken by Johnson in 2002⁽¹¹⁾. Johnson⁽¹¹⁾ identified three multi-component parameters (termed A, B and C), required to achieve the required J&E model output:

$$C_{air} = \alpha C_{vap} \times 1000000 \text{ cm}^3 \text{m}^{-3}$$

Where: C_{air} is the indoor air concentration, mg m^{-3}
 α is steady-state attenuation coefficient between soil and indoor air, dimensionless
 C_{vap} is the soil vapour concentration, mg cm^{-3}

Where additional parameters:

E_B is the enclosed space air exchange rate (d^{-1})

V_B is the enclosed space volume (m^3)

(Note – subscript B is not related to multi-component parameter B)

Depending on a variety of situations where movement of soil gas is controlled by either diffusion (slow) or advection (fast), Johnson identified solutions to the J&E model for the calculation of α based solely on the three multi-component parameters A , B and C .

The most **conservative** assumption is where movement of soil gas across the building foundation *via* advection is rate limiting, then:

$$\alpha \approx C \approx Q_{\text{soil}}/Q_B$$

Where: α = attenuation factor
 Q_{soil} = soil gas flow into building
 Q_B = building ventilation rate ($\text{cm}^3 \text{ s}^{-1}$)

For other situations where diffusion is assumed to be either dominant, or occurs in addition to advection (e.g. for a deeper source), then the solutions for α *via* parameters A and B are less conservative.

Assuming that the contaminant source in the soil gas is directly beneath the building foundation and that movement is controlled by advection (i.e. the most conservative assumption), then the attenuation factor α is the ratio of the flux of soil gas migration into the building (Q_{soil}) and the flux of air out of the building (building ventilation rate Q_B).

Guidance in SR3⁽³⁾ provides recommendations for the calculation of the ventilation rate Q_B as follows:

$$C = (H \times A_{\text{foot}} \times E_x) \times 1,000,000 \text{ cm}^3 \text{ m}^{-3} \times 1/3600 \text{ s hr}^{-1}$$

Where: H = height of living space (m)
 A_{foot} = building footprint (m^2)
 E_x = building air exchange rate (hr^{-1})

Approach to Calculation of vGAC

The building ventilation rate Q_B can be calculated for various building types (residential and commercial) using building parameters provided in Tables 3.3 and 4.21 in SR3⁽³⁾, and based on building air exchange rates (E_x) recommended in SR3⁽³⁾ for residential properties (0.5 h^{-1}) and commercial properties (1.0 h^{-1}).

Values for the volumetric flow rate into the building (Q_{soil}) are stated in SR3⁽³⁾, based on a combination of worst-case building parameters and soil type (crack/joint infill), and calculations

provided in Appendix 1 of SR3⁽³⁾, as 25 cm³ s⁻¹ and 150 cm³ s⁻¹ for the residential and commercial land uses, respectively.

The approach to calculating vGAC taken by RSK therefore bypasses direct use of the full J&E model algorithm and uses a simple dilution relationship ($Q_{\text{soil}} / Q_{\text{B}}$), which is more conservative and suitable for screening purposes. This approach also negates the requirement to measure (or assume) a variety of soil and other physical characteristics (e.g. soil volumetric moisture content, total porosity, molecular diffusion in air).

Attenuation factors (α) have been calculated on the basis of the above and are presented in Table 2.

This method of calculating attenuation factors from reasonably conservative vapour entry rates and indoor air exchange rates has been suggested in a recent (2014) paper⁽¹¹⁾ to offer a more technically defensible approach for the development of site specific attenuation factors, compared with a method that uses a comparison between paired, indoor air and sub-slab soil gas data in empirical databases.

As expected, attenuation is typically greater (α is a smaller value) for commercial properties than for residential properties. Calculation of vGAC, specific to both chemical and building type, has been undertaken through division of the HCV, specific to the critical receptor for a given end-use (e.g. residential or commercial), and the corresponding building-specific attenuation factor.

$$\text{vGAC} = \text{HCV} / \alpha$$

Health Criteria Values (HCV)

The HCV and background inhalation has been taken from the relevant SGV report⁽¹²⁾, published by Nathaniel et al.,⁽⁶⁾ or the CL:AIRE report⁽⁷⁾, as appropriate. The HCV have been amended for commercial, petrol (retail) and residential scenarios as follows:

- Commercial
 - An adult weighing 70kg and breathing 15.7m³ air per day in accordance with the revised exposure parameters used in the SP1010 final project report for the Category 4 Screening Levels (C4SL) (Table 3.2⁽¹³⁾) and USEPA data⁽¹⁴⁾
 - Background inhalation (mean daily intake(MDI)) for an adult (Age Class 17).
 - Background inhalation (mean daily intake (MDI)) for an adult (Age Class 17).
- Residential
 - A child weighing 13.3kg (average of 0-6 year old female in accordance with Table 4.6 of SR3⁽³⁾) and breathing 8.77m³ (average daily inhalation rate for a 0-6yr old female in accordance with SP1010 final project report for the C4SL (Table 3.2⁽¹³⁾) and USEPA data⁽¹⁴⁾
 - Background inhalation (mean daily intake (MDI)) for a child (Age Classes 1-6)

- Residential amendments to the MDI for younger age groups following Table 3.4 and Section 3.4.1 of SR2⁽²⁾; amended to reflect average daily inhalation rates in accordance with SP1010 final project report for the C4SL (Table 3.2⁽¹³⁾) and USEPA data⁽¹⁵⁾. Correction factors are presented in Table 1.

Amended HCV are shown in Table 3.

Note on Trimethylbenzenes

For trimethylbenzenes the CL:AIRE report⁽⁷⁾ based background inhalation from non-soil sources (MDI) on a Dutch study from 1985, which is reported to have identified an average daily dose of 1,2,4-trimethylbenzene of 86 $\mu\text{g d}^{-1}$ (1,3,5-trimethylbenzene was 20.5 $\mu\text{g d}^{-1}$). This dose value was based on the upper end of the identified concentration range of 1,2,4-trimethylbenzene (2.46 – 5.66 $\mu\text{g m}^{-3}$) and was used to calculate an a MDI of 1.23 $\mu\text{g kg}^{-1} \text{ bw d}^{-1}$ for a 70 kg adult breathing 20 m^3 of air daily.

The approach recommended in SR2⁽²⁾, and also adopted for the C4SLs⁽¹³⁾, for non-carcinogenic (threshold) compounds such as trimethylbenzenes is to subtract the MDI from the tolerable daily intake (TDI) to obtain a tolerable daily intake from soil (TDSI) in units of $\mu\text{g kg}^{-1} \text{ bw d}^{-1}$. For 1,2,4-trimethylbenzene, the adult MDI from the Dutch study used in the CL:AIRE report⁽⁷⁾ (1.23 $\mu\text{g kg}^{-1} \text{ bw d}^{-1}$) is a significant proportion of the TDI (2.0 $\mu\text{g kg}^{-1} \text{ bw d}^{-1}$), resulting in a low TDSI (1.0 $\mu\text{g kg}^{-1} \text{ bw d}^{-1}$) when the 50% rule is applied (i.e. $\text{TDSI} = \text{TDI} * 0.5$ when MDI is high relative to TDI). This TDSI equates to an Inhalation Reference Concentration (or modified Health Criteria Value) for adults of 3.4 $\mu\text{g m}^{-3}$ (70 kg adult breathing 15.7 $\text{m}^3 \text{ d}^{-1}$).

By comparison the adult inhalation modified HCV for benzene is 6.2 $\mu\text{g m}^{-3}$, which is proven human carcinogen (non-threshold compound).

The MDI for 1,2,4-trimethylbenzene is considered by RSK to be overly conservative for the following reasons:

- The Dutch 1985 study is dated and air quality has improved since this time
- The maximum value in the range (5.66 $\mu\text{g m}^{-3}$) was used in calculating the MDI
- Experience has shown that trimethylbenzenes often appear to drive inhalation risks to a greater extent than benzene, even though the latter is carcinogenic and more volatile.

As an alternative to the 1985 Dutch study, RSK have obtained automated roadside air quality monitoring data for the UK from www.uk-air.defra.gov.uk/. The average concentration of 1,2,4-trimethylbenzene measured during 2015 at Eltham, south-east London (urban) was 0.309 $\mu\text{g m}^{-3}$, significantly lower than that identified in the Dutch study and used by CL:AIRE⁽⁷⁾ for calculation of a MDI. Whilst an average concentration of 1,2,4-trimethylbenzene in UK urban and rural areas is likely to be significantly below 0.0.309 $\mu\text{g m}^{-3}$, this value is considered to be suitably conservative for the calculation of a modified HCV for trimethylbenzenes in the UK.

On this basis, the HCV for 1,2,4-trimethylbenzene for adults and children was calculated as 8.5 $\mu\text{g m}^{-3}$ (0.0085 mg m^{-3}) and 2.6 $\mu\text{g m}^{-3}$ (0.0026 mg m^{-3}), respectively (see Table 3). Due to the paucity of toxicological data for 1,2,3-trimethylbenzene and 1,3,5-trimethylbenzene the modified HCV for 1,2,4-trimethylbenzene is considered suitable for assessing total trimethylbenzenes.

RSK vGAC

RSK vGAC are presented in Table 4 for residential and commercial end-uses for common VOC and have also been calculated for common semi-volatile organic chemicals (sVOC), which may also have the potential to pose inhalation exposure risks.

RSK vGAC are simple screening criteria, in line with the principles of the CLEA model and the derivation of GAC, and are considered to be suitably conservative for use in a GQRA for the following reasons:

- Calculation of attenuation factors is based on the conservation assumption that the source lies directly beneath the foundation and that no additional depletion *via* diffusion occurs, i.e. attenuation is attributed solely to the dilution of soil gas as it moves through the foundation into indoor air
- The vGAC are applicable to the most conservative soil type
- Volumetric flow rate into buildings (Q_{soil}) is based on a combination of a sandy loam soil and parameters for a worst-case building type
- Biodegradation of VOC is not taken into account. Biodegradation of petroleum hydrocarbons can potentially attenuate soil gas concentrations and vapour intrusion by several orders of magnitude⁽¹⁵⁾.

RSK vGAC listed in Table 4 have been calculated for the most conservative residential (small terraced house) and commercial buildings (pre-1970 office). vGAC may be calculated for other residential and commercial buildings *via* attenuation factors listed in Table 1 and modified HCV listed in Table 3.

Uncertainties/Limitations

The use of the J&E model⁽¹⁰⁾ is considered to be inappropriate for site conditions where NAPL is present and potentially for use with modelling chlorinated hydrocarbons. The simplified RSK approach described negates these limitations provided representative soil gas concentrations are measured.

Use of the vGAC should only be undertaken with **detailed knowledge of the conceptual model and an understanding of the potential limitations in data** for the site and should be used as part of a multiple lines of evidence approach to assessing vapour intrusion. Note that the compounds listed in tables are not exhaustive and VOC not listed may have the potential to pose an indoor inhalation risk.

vGAC listed in Table 4 may not be relevant or suitably protective where VOC migration is dominated by ground gas (carbon dioxide and methane) pressure driven flow or where other mechanisms leading to VOC exposure from soils (e.g. ingestion, dermal, dust inhalation) are active. vGAC may also not be relevant where the direct impact of foundation structures with impacted groundwater or NAPL occurs.

vGAC are not to be used for screening indoor or outdoor air quality results, where direct inhalation exposure is possible. In this scenario relevant inhalation HCV are suitable for use as screening criteria (for acceptable exposure) such as those in Table 3.

The conceptual model associated with the vGAC does not consider vapour intrusion along drainage pipes/backfill and migration into a building.

Table 1: Correction factors used to adjust adult MDI to younger age groups

Age Class	Body weight (kg) ¹	Inhalation rate (m ³ /day) ²	Correction factor for inhalation MDI ³
1	5.6	5.4	0.34
2	9.8	8	0.51
3	12.7	8.9	0.57
4	15.1	10.1	0.64
5	16.9	10.1	0.64
6	19.7	10.1	0.64
17	70	15.7	-
Mean (AC1-6)	13.3	8.8	0.56
Notes ¹ Body weight from CLEA v1.06 ² Inhalation rate from Table 3.2 of the SP1010 final project report for the C4SL ⁽¹³⁾ ³ Inhalation correction factors are the ratio of the average male and female inhalation rates for each age class to the adult rate at age class 17 (age 16–59 years) and are based on the rates used by the Category 4 Screening Levels to derive the C4SLs ⁽¹³⁾ , following the methodology in SR2 ⁽²⁾ .			



Table 2: α Attenuation Factors for a Variety of Residential and Commercial Buildings.

Receptor	Building Living Space Height - H (m) ^a	Building Footprint A_{foot} (m ²) ^a	Building Air Exchange Rate (hr ⁻¹) ^a	Building Ventilation Rate Q_B (cm ³ s ⁻¹) ^b	Soil Gas Flow Rate into Building Q_{soil} (cm ³ s ⁻¹) ^c	Attenuation Factor - Alpha = Q_{soil}/Q_B ^d	Degree of Attenuation
Residential - Bungalow	2.4	78	0.5	22472	25	0.00096	1040
Residential - Small Terrace House	4.8	28	0.5	9250	25	0.00134	747
Residential - Medium/Large Terrace House	4.8	44	0.5	13694	25	0.00085	1173
Residential - Semi-Detached House	4.8	43	0.5	13417	25	0.00087	1147
Residential - Detached House	4.8	68	0.5	20361	25	0.00055	1813
Commercial - Warehouse (pre-1970)	5.2	1089	1	304222	150	0.00008	12584
Commercial - Warehouse (post-1970)	5.9	1914	1	533583	150	0.00004	25095
Commercial - Office (pre-1970)	10.2	424	1	120889	150	0.00010	9611
Commercial - Office (post-1970)	13	610	1	173333	150	0.00006	17622

Notes:

^a From Table 3.3 and 4.21, SR3⁽³⁾

^b Equation 10.5, SR3⁽³⁾

^c Generic flow rate, Section 10.3, SR3⁽³⁾

^d Most conservative assumption where advection across foundation is rate limiting⁽⁸⁾

Table 3: Amended Health Criteria Values

VOC / SVOC	Modified HCV (mg/m ³) ¹	
	Child (Residential)	Adult (Commercial)
MTBE	1.0803	3.2064
Benzene	0.0021	0.0062
Toluene	2.1164	6.2362
Ethylbenzene	0.1113	0.3301
Xylenes	0.0808	0.2586
Trimethybenzenes	0.0026	0.0085
TPH_Aliph EC5-EC6	3.7913	11.1465
TPH_Aliph >EC6-EC8	3.7913	11.1465
TPH_Aliph >EC8-EC10	0.2199	0.6465
TPH_Aliph >EC10-EC12	0.2199	0.6465
TPH_Aliph >EC12-EC16	0.2199	0.6465
TPH_Arom >EC8-EC10	0.0455	0.1338
TPH_Arom >EC10-EC12	0.0455	0.1338
TPH_Arom >EC12-EC16	0.0455	0.1338
Acenaphthene	0.0910	0.2675
Acenaphthylene	0.0910	0.2675
Naphthalene	0.0011	0.0037
Vinyl chloride	0.0005	0.0013
Dichloroethane-1,2	0.0002	0.0005
Tetrachloroethene	0.0083	0.0363
Carbon tetrachloride	0.0025	0.0114
Trichloroethane-1,1,1	0.9099	2.6752
Trichloroethene	0.0009	0.0025
Tetrachloroethane 1,1,2,2 & 1,1,1,2	0.0086	0.0257
1,1,2-Trichloroethane	0.0073	0.0216
1,1-dichloroethane	0.3030	0.8915
1,1-dichloroethene	0.0864	0.2541
Chloroethane	4.3318	12.7374
Chloromethane	0.0039	0.0115
cis-1,2-dichloroethene	0.0087	0.0264
Dichloromethane	0.1781	0.5765
trans-1,2-dichloroethene	0.0253	0.0754
Trichloromethane (chloroform)	0.0570	0.1752
¹ Inhalation HCV has taken account of background inhalation for threshold compounds only		

Table 4: RSK vGAC – Single Exposure Route

Volatile Organic Compound	vGAC (mg/m ³)	
	Residential (Small Terrace House)	Commercial (Office pre-1970)
Attenuation factor (α)	0.00134	0.00010
MTBE	807	25679
Benzene	1.59	49.99
Toluene	1580	49945
Ethylbenzene	83.1	2644
Xylenes	62.3	2089
Trimethylbenzenes	1.9	68.3
TPH_Aliph EC5-EC6	2831	89271
TPH_Aliph >EC6-EC8	2831	89271
TPH_Aliph >EC8-EC10	164	5178
TPH_Aliph >EC10-EC12	164	5178
TPH_Aliph >EC12-EC16	164	5178
TPH_Arom >EC8-EC10	34	1071
TPH_Arom >EC10-EC12	34	1071
TPH_Arom >EC12-EC16	34	1071
Acenaphthene	68	2142
Acenaphthylene	68	2142
Naphthalene	0.82	29.3
Vinyl chloride	0.34	10.7
Dichloroethane-1,2	0.14	4.3
Tetrachloroethene	6.23	291
Carbon tetrachloride	1.8457	91
Trichloroethane-1,1,1	679	21425
Trichloroethene	0.6	20
Tetrachloroethane 1,1,2,2 & 1,1,1,2	6.5	206
1,1,2-Trichloroethane	5.4	173
1,1-dichloroethane	226	7140
1,1-dichloroethene	65	2035
Chloroethane	3234	102012
Chloromethane	2.9	91.8
cis-1,2-dichloroethene	6.5	211
Dichloromethane	133	4617
trans-1,2-dichloroethene	18.9	604
Trichloromethane (chloroform)	42.6	1403

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APPENDIX K

GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS

APPENDIX K

GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS

Several compounds can inhibit plant growth; hence it is important to have generic assessment criteria (GAC) to promote healthy plant growth. In the absence of other published GAC, the GAC have been obtained from legislation (UK and European) and guidance related to the use of sewage sludge on agricultural fields.

The Council of European Communities Sewage Sludge Directive (86/278/EEC) dated 1986, has been transposed into UK law by Statutory Instrument No. 1263, The Sludge (use in Agriculture) Regulations 1989 (Public Health England, Wales and Scotland), as ammended in 1990 and The Sludge (use in Agriculture) Regulations (Northern Ireland) SR No, 245, 1990. In addition the Department of Environment (DoE) produced a Code of Practice (CoP) (Updated 2nd Edition) in 2006 which provided guidance on the application of sewage sludge on agricultural land (however the status of this document is unclear as it is on the archive section of the Defra website).

The directive seeks to encourage the use of sewage sludge in agriculture and to regulate its use in such a way as to “**prevent harmful effects on soil, vegetation, animals and man**”. To this end, it prohibits the use of untreated sludge on agricultural land unless it is injected or incorporated into the soil. Treated sludge is defined as having undergone "biological, chemical or heat treatment, long-term storage or any other appropriate process so as significantly to reduce its fermentability and the health hazards resulting from its use". To provide protection against potential health risks from residual pathogens, sludge must not be applied to soil in which fruit and vegetable crops are growing, or less than ten months before fruit and vegetable crops are to be harvested. Grazing animals must not be allowed access to grassland or forage land less than three weeks after the application of sludge.

The specified limits of concentrations of selected elements in soil are presented in Table 4 of the updated 2nd Edition of the DoE Code of Practice and are designed to protect plant growth. It is noted that these values are more stringent than the values set in current UK regulations. However since they were ammended following recommendations from the Independent Scientific Committee in 1993. (MAFF/DOE 1993). The GAC are presented in Table 1.

Table 1: Generic assessment criteria

Determinant	Generic assessment criteria (mg/kg)			
	pH 5.0 < 5.5	pH 5.5 < 6.0	pH 6.0 < 7.0	pH >7.0
Zinc	200	200	200	300
Copper	80	100	135	200
Nickel	50	60	75	110
Lead	300	300	300	300
Cadmium	3	3	3	3
Mercury	1	1	1	1
Note: Only compounds with assessment criteria documented within the Directive 86/278/EEC have been included, although criteria for 5 additional compounds have been presented within the 2006 CoP.				

APPENDIX L

GENERIC ASSESSMENT CRITERIA POTABLE WATER SUPPLY PIPES

A range of pipe materials is available and careful selection, design and installation is required to ensure that water supply pipes are satisfactorily installed and meet the requirements of the Water Supply (Water Fittings) Regulations 1999 in England and Wales, the Byelaws 2000 in Scotland and the Northern Ireland Water Regulations. The regulations include a requirement to use only suitable materials when laying water pipes and laying water pipes without protection is not permitted at contaminated sites. The water supply company has a statutory duty to enforce the regulations.

Contaminants in the ground can pose a risk to human health by permeating potable water supply pipes. To fulfil their statutory obligation, UK water supply companies require robust evidence from developers to demonstrate either that the ground in which new plastic supply pipes will be laid is free from specific contaminants, or that the proposed remedial strategy will mitigate any existing risk. If these requirements cannot be demonstrated to the satisfaction of the relevant water company, it becomes necessary to specify an alternative pipe material on the whole development or in specific zones.

In 2010, UK Water Industry Research (UKWIR) published *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (Report Ref. No. 10/WM/03/21). This report reviewed previously published industry guidelines and threshold concentrations adopted by individual water supply companies.

The focus of the UKWIR research project was to develop clear and concise procedures, which provide consistency in the pipe selection decision process. It was intended to provide guidance that can be used to ensure compliance with current regulations and to prevent water supply pipe failing prematurely due to the presence of contamination.

The report concluded that in most circumstances only organic contaminants pose a potential risk to plastic pipe materials and Table 3.1 of the report provides threshold concentrations for polyethylene (PE) and polyvinyl chloride (PVC) pipes for the organic contaminants of concern. The report also makes recommendations for the procedures to be adopted in the design of site investigations and sampling strategies, and the assessment of data, to ensure that the ground through which water supply pipes will be laid is adequately characterised.

Risks to water supply pipes have therefore been assessed against the threshold concentrations for PE and PVC pipe specified in Table 3.1 of Report 10/WM/03/21, which have been adopted as the GAC for this linkage and are reproduced in Table A3 below.

Since water supply pipes are typically laid at a minimum depth of 0.75 m below finished ground levels, sample results from depths between 0.5 m and 1.5 m below finished level are generally considered suitable for assessing risks to water supply. Samples outside these depths can be used, providing the stratum is the same as that in which water supply pipes are likely to be located. The report specifies that sampling should characterise the ground conditions to a minimum of 0.5 m below the proposed depth of the pipe.

It should be noted that the assessment provided in this report is a guide and the method of assessment and recommendations should be checked with the relevant water supply company.

Table Q1: Generic assessment criteria for water supply pipes

		Pipe material	
		GAC (mg/kg)	
	Parameter group	PE	PVC
1	Extended VOC suite by purge and trap or head space and GC-MS with TIC (Not including compounds within group 1a)	0.5	0.125
1a	BTEX + MTBE	0.1	0.03
2	SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C ₅ –C ₁₀) (Not including compounds within group 2e and 2f)	2	1.4
2e	Phenols	2	0.4
2f	Cresols and chlorinated phenols	2	0.04
3	Mineral oil C ₁₁ –C ₂₀	10	Suitable
4	Mineral oil C ₂₁ –C ₄₀	500	Suitable
5	Corrosive (conductivity, redox and pH)	Suitable	Suitable
Specific suite identified as relevant following site investigation			
2a	Ethers	0.5	1
2b	Nitrobenzene	0.5	0.4
2c	Ketones	0.5	0.02
2d	Aldehydes	0.5	0.02
6	Amines	Not suitable	Suitable
Notes: where indicated as 'suitable' the material is considered resistant to permeation or degradation and no threshold concentration has been specified by UKWIR.			

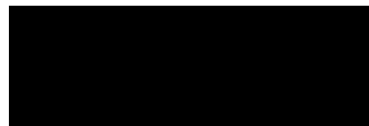
APPENDIX M

RESULTS OF VAPOUR MONITORING

Element Materials Technology

Report:	Gas	Sample ID	WS205	WS206	WS202	WS201	WS203	WS201	WS202	WS206	WS205	WS203
		Depth										
		Sample Type	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas
		Sampled Date	11/02/2022	11/02/2022	11/02/2022	11/02/2022	11/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022
Client:	RSK Group Plc	Sample Received Date	23/02/2022	23/02/2022	23/02/2022	23/02/2022	23/02/2022	23/02/2022	23/02/2022	23/02/2022	23/02/2022	23/02/2022
Client ref:	29780	EMT Sample No	1	2	3	4	5	6	7	8	9	10
Location:	Arundel Gasworks	Batch Number	1	1	1	1	1	1	1	1	1	1
Contact	Andrew Tranter											

Test	Method	Units	LOD										
VOC MS													
Methyl tertiary butyl ether	TM68/PM0	ppbv	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Benzene [#]	TM68/PM0	ppbv	<1.5	14.2	22.5	2167.1	413376.1	234.2	168055.9	12682.2	9982	3127.8	1643.8
Toluene [#]	TM68/PM0	ppbv	<1.5	18.7	48.8	159.7	105686.8	74.8	23297.8	4427.9	3776.9	1459.8	1136.9
Ethylbenzene [#]	TM68/PM0	ppbv	<1.5	<1.5	7.4	12.4	1054.5	2.1	226.3	55.9	80.8	21.8	26.1
m/p-Xylene [#]	TM68/PM0	ppbv	<1.5	2.6	35.3	88	9730.3	12	1833.8	423.5	678.5	185.7	212.2
o-Xylene [#]	TM68/PM0	ppbv	<1.5	<1.5	2.5	48.7	2457.6	8.2	421.1	92.7	180.2	45.6	55.6
Methyl tertiary butyl ether	TM68/PM0	ug/m3	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4	<5.4
Benzene [#]	TM68/PM0	ug/m3	<4.8	45.4	71.9	6922.9	1320557	748.2	536865.6	40514.1	31888.2	9992	5251.2
Toluene [#]	TM68/PM0	ug/m3	<5.7	70.5	183.9	601.7	398223.6	281.8	87785.2	16684.1	14231.2	5500.5	4283.8
Ethylbenzene [#]	TM68/PM0	ug/m3	<6.5	<6.5	32.1	53.8	4578.4	9.1	982.5	242.7	350.8	94.7	113.3
m/p-Xylene [#]	TM68/PM0	ug/m3	<6.5	11.3	153.3	382.1	42250.6	52.1	7962.7	1838.9	2946.2	806.3	921.4
o-Xylene [#]	TM68/PM0	ug/m3	<6.5	<6.5	10.9	211.5	10671.3	35.6	1828.5	402.5	782.5	198	241.4
4-Bromofluorobenzene Surrogate Recovery	TM68/PM0	%	<0	90	92	94	119	92	104	97	98	96	96
VOC CWG MS													
Aliphatic >C4-C6	TM68/PM0	ppbv	<10	109	35	531	3074	87	2111	1003	128	285	55
Aliphatic >C6-C8	TM68/PM0	ppbv	<10	64	25	2629	39330	186	26286	8068	6315	2384	1334
Aliphatic >C8-C10	TM68/PM0	ppbv	<10	533	13	699	10728	227	1888	557	1349	341	331
Aliphatic >C10-C12	TM68/PM0	ppbv	<10	33	<10	30	621	54	60	15	58	15	44
Aromatic >C5-EC7 (Benzene)	TM68/PM0	ppbv	<1.5	14.2	22.5	2167.1	413376.1	234.2	168055.9	12682.2	9982	3127.8	1643.8
Aromatic >EC7-EC8 (Toluene)	TM68/PM0	ppbv	<1.5	18.7	48.8	159.7	105686.8	74.8	23297.8	4427.9	3776.9	1459.8	1136.9
Aromatic >EC8-EC10	TM68/PM0	ppbv	<10	<10	172	219	13395	116	2870	849	1281	291	431
Aromatic >EC10-EC12	TM68/PM0	ppbv	<10	<10	<10	<10	316	91	20	<10	24	<10	<10
Aliphatic >C4-C6	TM68/PM0	ug/m3	<33	361	116	1759	10183	288	6993	3323	424	944	182
Aliphatic >C6-C8	TM68/PM0	ug/m3	<41	262	102	10752	160853	761	107505	32997	25827	9750	5456
Aliphatic >C8-C10	TM68/PM0	ug/m3	<53	2834	69	3716	57038	1207	10038	2961	7172	1813	1760
Aliphatic >C10-C12	TM68/PM0	ug/m3	<65	216	<65	196	4064	353	393	98	380	98	288
Aromatic >C5-EC7 (Benzene)	TM68/PM0	ug/m3	<4.8	45.4	71.9	6922.9	1320557	748.2	536865.6	40514.1	31888.2	9992	5251.2
Aromatic >EC7-EC8 (Toluene)	TM68/PM0	ug/m3	<5.7	70.5	183.9	601.7	398223.6	281.8	87785.2	16684.1	14231.2	5500.5	4283.8
Aromatic >EC8-EC10	TM68/PM0	ug/m3	<49	<49	844	1075	65740	569	14085	4167	6287	1428	2115
Aromatic >EC10-EC12	TM68/PM0	ug/m3	<53	<53	<53	<53	1680	484	106	<53	128	<53	<53



RSK Group Plc
18 Frogmore Road
Hemel Hemstead
HP3 9RT



Attention : Andrew Tranter
Date : 4th March, 2022
Your reference : 29780
Our reference : Test Report 22/2948 Batch 1
Location : Arundel Gasworks
Date samples received : 23rd February, 2022
Status : Final Report
Issue : 1

Twelve samples were received for analysis on 23rd February, 2022 of which ten were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:



Simon Gomery BSc
Project Manager

Please include all sections of this report if it is reproduced

Client Name: RSK Group Plc
Reference: 29780
Location: Arundel Gasworks
Contact: Andrew Tranter

Sample ID:	WS202
Depth:	
EMT Job No:	22/2948
EMT Sample No:	3
Matrix:	Air
Method:	TM68 VOCs in gases (GC-MS)

Q* - Qualifiers

Key

RL Reporting Limit

ISO 17025 (UKAS) accredited

QF-PM 3.1.13 v6
RICT COUNCIL AB/51/22/DOC

Client Name: RSK Group Plc
Reference: 29780
Location: Arundel Gasworks
Contact: Andrew Tranter

Sample ID:	WS201
Depth:	
EMT Job No:	22/2948
EMT Sample No:	4
Matrix:	Air
Method:	TM68 VOCs in gases (GC-MS)

Q* - Qualifiers

Key

RL Reporting Limit

ISO 17025 (UKAS) accredited

QF-PM 3.1.13 v6
RICT COUNCIL AB/51/22/DOC

Client Name: RSK Group Plc
Reference: 29780
Location: Arundel Gasworks
Contact: Andrew Tranter

Sample Date: 17 Feb 2022
Date of Receipt: 23 Feb 2022
Date Analysed: 24 Feb 2022

Sample ID:	WS201
Depth:	
EMT Job No:	22/2948
EMT Sample No:	6
Matrix:	Air
Method:	TM68 VOCs in gases (GC-MS)

Sample Train Serial number:

B Indicates analyte found in associated method blank
++ Indicates value exceeds calibration range

MDL	Method Detection Limit
RL	Reporting Limit
#	ISO 17025 (UKAS) accredited

QF-PM 3.1.13 v6
RICT COUNCIL AB/51/22/DOC

Client Name: RSK Group Plc
Reference: 29780
Location: Arundel Gasworks
Contact: Andrew Tranter

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/2948

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x50 Dilution
AB	x100 Dilution

EMT Job No: 22/2948

[illegible]

APPENDIX N PREVIOUS CORRESPONDENCE WITH THE ENVIRONMENT AGENCY

Arun District Council
Development Control
1, Arun Civic Centre Maltravers Road
Littlehampton
West Sussex
BN17 5LF

Our ref: HA/2021/123131/01-L01
Your ref: AB/45/21/PL
Date: 11 May 2021

Dear Sir/Madam

THE PLANNING APPLICATION IS FOR REMEDIATION WORKS TO MITIGATE POTENTIAL LIABILITIES ASSOCIATED WITH GROUND CONDITIONS RESULTING FROM THE SITE'S HISTORIC USE AS A GASWORKS.

FORMER GASHOLDER STATION (LAND OPPOSITE ARUNDEL CEMETRY) FORD ROAD ARUNDEL

Thank you for consulting the Environment Agency on the above application.

Environment Agency Position

We have **no objection** to the proposed development as submitted, **subject to the inclusion of the following 2 conditions**, in any permission granted.

We consider that planning permission could be granted to the proposed development, as submitted, if the following planning conditions are included as set out below. Without these conditions, the proposed development on this site poses an unacceptable risk to the environment and we would object to the application.

Conditions

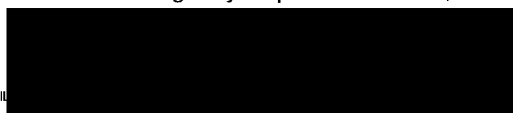
Condition 1 – Verification report

A verification report is required, demonstrating the completion of works set out in the approved remediation strategy and the effectiveness of the remediation shall be submitted to, and approved in writing, by the local planning authority. The report shall include results of sampling and monitoring carried out in accordance with the approved verification plan to demonstrate that the site remediation criteria have been met.

Reason(s)

This condition is required to ensure that the site does not pose any further risk to human health or the water environment by demonstrating that the requirements of the approved verification plan have been met and that remediation of the site is complete. This is in line with paragraph 170 of the National Planning Policy Framework.

Environment Agency
Environment Agency Depot Canal Walk, Romsey, Hampshire, SO51 7LP.



We have reviewed the Supplementary Site Investigation Factual Report (Dec 2020) and Remediation Implementation and Verification Plan (March 2021). We note the intended end use and remediation measures are based on an intended open storage end use and a programme of site excavation and turnover is proposed to identify, segregate and treat contaminated soils where appropriate. Groundwater treatment is proposed to deal with NAPL contamination and impacted perched water during excavation works.

Condition 2 – Previously unidentified contamination

If, during development, contamination not previously identified is found to be present at the site then no further development (unless otherwise agreed in writing with the local planning authority) shall be carried out until a remediation strategy detailing how this contamination will be dealt with has been submitted to, and approved in writing by, the local planning authority. The remediation strategy shall be implemented as approved.

Reason(s)

To ensure that the development does not contribute to, is not put at unacceptable risk from, or adversely affected by, unacceptable levels of water pollution from previously unidentified contamination sources at the development site. This is in line with paragraph 170 of the National Planning Policy Framework.

Advice to Local Planning Authority/Applicant

The site comprises made ground, overlying superficial alluvial deposits which sit upon the Spetisbury Chalk principal aquifer. Groundwater is very shallow, only 1-3m below ground level and the River Arun is 40m to the south east. Groundwater flow is generally towards the river to the east, however it is tidally influenced.

There is widespread contamination in the made ground across the site, which is higher in the north and east associated with the gas holder and associated infrastructure. Deeper hydrocarbon and NAPL contamination tends to be focused in the soils and perched water to the north east.

We would highlight that this application only addresses the current contamination aspects, relating to continued use for open storage following remediation. Our response covers this continuation of current use for open storage. Any additional future development could create additional pathways, such as through site drainage or piling, and may result in the need for additional remediation in the future which would be dealt with through the planning system.

Requirement for an Environmental permit

The dewatering and remediation works associated with this development will require an Environmental Permit under the Environmental Permitting (England & Wales) Regulations 2016, from the Environment Agency, unless an exemption applies. The applicant is advised to contact the Environment Agency on [REDACTED] for further advice and to discuss the issues likely to be raised. You should be aware that there is no guarantee that a permit will be granted. Additional 'Environmental Permitting Guidance' can be found at: <https://www.gov.uk/environmental-permit-check-if-you-need-one>.

Waste on-site

The CL:AIRE Definition of Waste: Development Industry Code of Practice (version 2) provides operators with a framework for determining whether or not excavated material arising from site during remediation and/ or land development works are waste or have ceased to be waste. Under the Code of Practice:

- excavated materials that are recovered via a treatment operation can be re-used on-site providing they are treated to a standard such that they fit for purpose and unlikely to cause pollution

- treated materials can be transferred between sites as part of a hub and cluster project
- some naturally occurring clean material can be transferred directly between sites

Developers should ensure that all contaminated materials are adequately characterised both chemically and physically, and that the permitting status of any proposed on-site operations are clear. If in doubt, the Environment Agency should be contacted for advice at an early stage to avoid any delays.

We recommends that developers should refer to:

- the position statement on the Definition of Waste: Development Industry Code of Practice
- The waste management page on GOV.UK

Waste to be taken off-site

Contaminated soil that is (or must be) disposed of is waste. Therefore, its handling, transport, treatment and disposal are subject to waste management legislation, which includes:

- Duty of Care Regulations 1991
- Hazardous Waste (England and Wales) Regulations 2005
- Environmental Permitting (England and Wales) Regulations 2016
- The Waste (England and Wales) Regulations 2011

Developers should ensure that all contaminated materials are adequately characterised both chemically and physically in line with British Standard BS EN 14899:2005 'Characterization of Waste - Sampling of Waste Materials - Framework for the Preparation and Application of a Sampling Plan' and that the permitting status of any proposed treatment or disposal activity is clear. If in doubt, the Environment Agency should be contacted for advice at an early stage to avoid any delays.

If the total quantity of hazardous waste material produced or taken off-site is 500kg or greater in any 12 month period, the developer will need to register with us as a hazardous waste producer. Refer to the hazardous waste pages on GOV.UK for more information.

Should you have any further queries please do not hesitate to contact me.

Yours faithfully

Miss Hannah Brothwell
Sustainable Places Advisor



cc Celtic Technologies Limited