

To: Wessex Water
File: 330201558 Wessex Water IED HRAs

From: Stantec
Date: September 30, 2022

Reference: Potential Sources of Contamination – Avonmouth Water Recycling Centre, Bioresources Centre – Supporting Information for H5 Site Condition Report, Version 1.

BACKGROUND

Wessex Water Services Limited is required to meet conditions under the Industrial Emissions Directive (IED). An Environmental Permit is required for the Bioresources Centre (BRC) (the Site) located within Avonmouth Water Recycling Centre (WRC).

As part of the environmental permit application an Environmental Quantitative Risk Assessment (EQRA) (Stantec, 2022), has been undertaken for the Avonmouth BRC. The EQRA provides a Compliance Action Plan (CAP) detailing the site specific actions required at the Avonmouth BRC to ensure IED compliance. The EQRA will be used to identify the mitigation measures that are required to reduce the risk of pollution to ground or local water environment to comply with the IED. To support the EQRA process, a desk-top preliminary hydrogeological study for the Avonmouth BRC has been undertaken and is presented within the EQRA.

In addition to the EQRA, an H5 Site Condition Report (SCR) (Stantec, 2022) has been completed for the Avonmouth BRC. The purpose of the SCR is to describe and record the baseline conditions of the land and groundwater at the Site at the point of application/ start of operations.

To support the SCR, this memo documents a review of environmental data to identify potential sources of contamination at the Site and within the surroundings, resulting from historical and/ or current land uses/ activities.

This memo should be read in conjunction with the SCR and EQRA.

SITE SETTING

The Site is located at:

Avonmouth Bioresources Centre
Kings Weston Lane
Avonmouth
Bristol
BS11 0YS
United Kingdom.

National Grid Reference: (approximate BRC centre): ST533793; Coordinates: 353358, 179392.

The Avonmouth site is located in the north of Avonmouth which is a suburb of Bristol, at approximately 8 km northwest of Bristol city centre. The Site is in a rural / industrial area with industrial units to the north and west but rural fields to the south and east. The Site is located in the north of Avonmouth and the M49 lies approximately 400 m to the east. The Mouth of the Severn lies approximately 1.8 km west of the Site where the River Severn joins the Severn Estuary and flows in a southerly direction towards Bristol Channel and the sea. Drains run along the southern boundary of the Site (Mere Bank Rhine) and within 200 m of the northern and eastern boundaries.

The topography at the Site is generally flat at an elevation of approximately 6 to 8 mAOD. Ground levels at the Site are similar to the surrounding land but there is a decrease in elevation along the drains and rivers in close proximity to the Site.

Further information on site setting, including geology, hydrogeology and hydrology is provided in the EQRA.

HISTORICAL GROUND INVESTIGATION

Reports for 8 Site Investigations (SI) have been provided for the Avonmouth WRC.

- C.J. Associates drilled 14 boreholes (BH No: 1 – 14) and excavated 12 trial pits (TP No 1 – 12) in 2001, however no location plans are available.
- C.J. Associates drilled 5 boreholes (BH No: 1 – 5), 11 window samples and excavated 11 trial pits (TP No 1 – 11) and one hand auger pit in 2002 around the storm tanks and new digester [37].
- Foundation Engineering Ltd drilled four boreholes (BH1 to BH4) in 1980 beneath the sludge consolidation tanks [22 and 23] and to the north of the blending tank [E] and centrifuges [G].
- Norwest Holst excavated two trial pits to the east and west of the digesters [P] in 2007.
- Quantum Geotech (2021) drilled 13 boreholes (BH101 – BH113) and excavated 8 trial pits (MDTP101 – MDTP108) within the field to the south of the Site, around the new PST sludge buffer tank [35] in 2021.
- Quantum Geotech excavated 5 trial pits (TPE01 – TPE05) in 2021, however no location plans were provided. The logs are titled 'Avonmouth Cake Slab' and therefore it is assumed these are located near to the new cake pad [36].
- Structural Soils Limited drilled two boreholes in 1991 (BH1 – BH2) to the east of the sludge consolidation tanks [22 and 23].
- Soil Mechanics drilled four boreholes (BH1 – BH4) in 1978 within the wider WRC, 45 m to the northeast of the new PST sludge buffer tank [35].

Figure 4.1 extracted from the EQRA shows the locations of the exploratory holes completed as part of the SIs, in addition to British Geological Survey (BGS) Boreholes available (BGS, 2022).

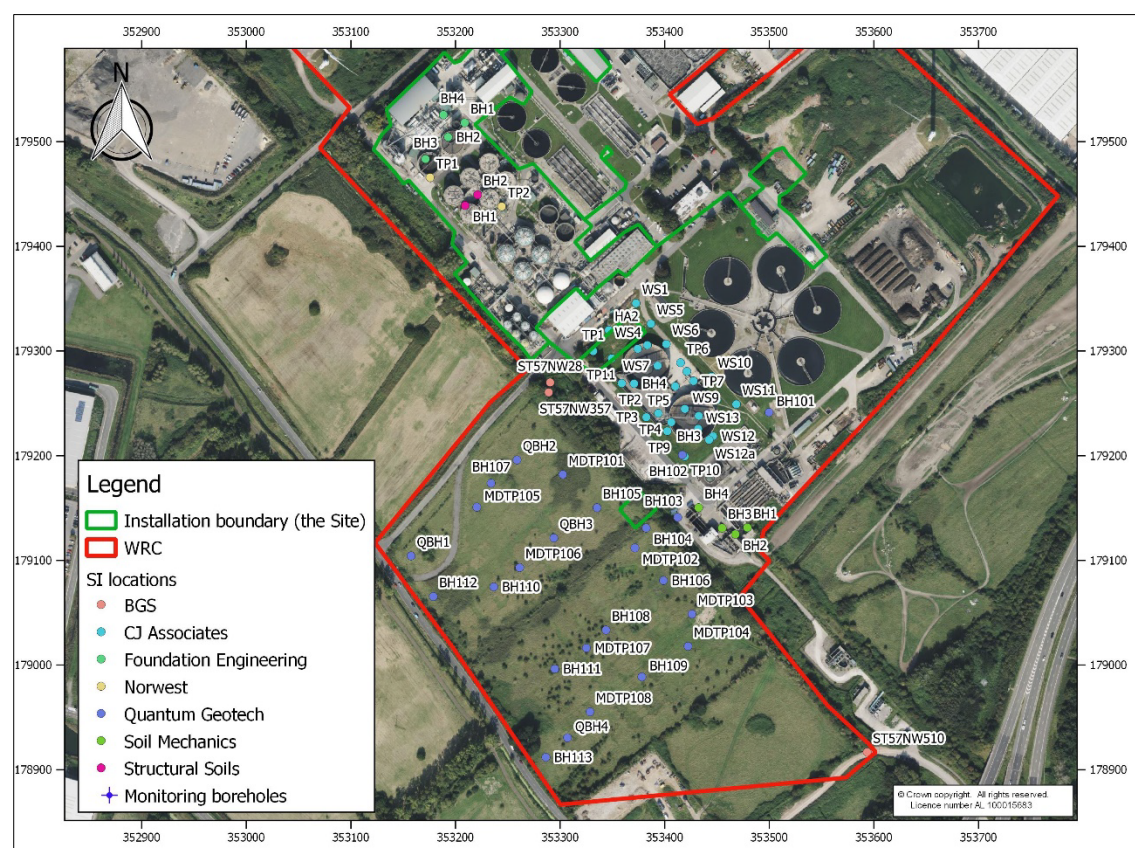


Figure 4.1 Previous Ground Investigations Exploratory Hole Location Plan (current BRC boundary)

Strata Encountered

A review of the strata encountered as reported on the exploratory hole logs is detailed within the EQRA Section 4.0, but is also summarised as follows:

Made Ground

Made Ground was encountered in the majority of locations and was generally described as firm to stiff, brown silty clay, with some fine to coarse subangular gravel. Where identified, the Made Ground is present at a thickness of between 0.4 m to 4.2 m across the Site but is generally 1 m to 2 m thick. Made Ground was sparsely recorded by Quantum Geotech (2021) to the south of the Site in the field that the new PST sludge buffer tank [35] is located in which is consistent with regional mapping (see Appendix A) which displays the Site being underlain by Made Ground but not the land to the south.

Halcrow (1998) stated that hydrocarbon odours and sewage remnants were encountered in the Made Ground.

Superficial Quaternary Deposits: Alluvium

Superficial deposits were recorded in all boreholes either underlying the Made Ground, where present, or directly beneath topsoil. The Tidal Flat Deposits are comprised of interbedded layers of clay and silt at a confirmed thickness of between 13.7 m and 20.3 m across the Site. This ranges from firm grey-brown mottled orange slightly sandy slightly gravelly clay to very soft to soft, brown-blue-grey slightly sandy silt and clay. Intermittent thin layers of peat were recorded in numerous boreholes at thicknesses of approximately 0.15 m.

Bedrock

Mapping shows that bedrock at the Site is the Mercia Mudstone Group. The Mercia Mudstone Group transitions through a weathered zone between the Tidal Flat Deposits and into the mudstone/siltstone however the zone is not well defined. The weathered zone it is generally described as very stiff red-brown silty clay with gravel sized lithorelicts. This then transitions downwards into very weak thinly laminated reddish brown mudstone and strong, red-brown occasionally grey-green mottled thinly bedded siltstone.

There are two BGS boreholes and one trial pit that are located on Site which are broadly in agreement with the site investigation locations detailed above. These confirm around 15 m of clay and silt (i.e. Tidal Flat Deposits) underlain by sandy marl and mudstone with thin bands of gypsum and selenite (i.e. Mercia Mudstone Group). These deeper BGS boreholes record that Coal Measures were identified beneath the Mercia Mudstone Group from around 52 mbgl.

Further information on the geology encountered during these GI at the BRC and wider WRC is provided in the EQRA.

Geo-Environmental Analysis

Out of the 8 SI reports existing for the Site, the following include geo-environmental chemical testing:

- Quantum Geotech (2021)
- Aecom (2021)
- Halcrow (1998)

Wood (2019, 2020 and 2021) also include groundwater chemical testing at the Site.

Table A1 presented in Appendix A summarises the geo-environmental soil samples available for review.

Soil Analysis

Aecom (2021) concluded the below regarding the various site investigations where we were only provided the logs:

- Norwest (2007): samples within Made Ground taken from the trial pits were tested for metals and organics, no exceedances against available evaluation criteria (EC) for human health were noted.
- C.J.Associates Geotechnical Ltd (2002): 22 soil samples from between 0.2 to 2.5 mbgl from Made Ground and Tidal Flat Deposits. No exceedances were noted when contamination test results were screened against the available EC for human health. Leachate analysis conducted on six samples also yielded no exceedances against available EC for human health. Elevated levels of zinc were noted in soil sample results, in comparison to other heavy metal concentrations, ranging from 84 to 1100 mg/kg. Isolated elevated lead concentrations above 100 mg/kg were noted in nine soil samples with a maximum concentration of 530 mg/kg. Elevated concentrations of lead were noted within a depth range of 0.2 to 1.7 mbgl.
- C.J.Associates Geotechnical Ltd (2001): no geo-environmental samples were taken or tested.
- A draft Geotechnical Report (31/01 Draft 2, May 2001) was undertaken by Arup and presented an interpretation of the findings of C.J. Associates Geotechnical Ltd (2001) for locations along the north-eastern boundary. This report was not provided but Aecom summarised that the results of chemical analyses and site observations suggest the ground beneath the site is largely uncontaminated. However, the upper layer of material contained measurable concentrations of zinc (344.1 – 1012 mg/kg) in particular, but also sulphates (2350 – 2491 mg/kg) and elemental sulphur (5105 – 10185 mg/kg). Depths of analysed soil samples ranged from 0.1 – 2.5 mbgl. Comparison of leachate test results with published guidelines indicates that the top 0.3 m of material on site is likely to be classified as inert. Detectable sulphur and sulphate concentrations were limited to Trial Pits 4 and 5, located along the north-eastern boundary, which could relate to naturally occurring deposits or 'hot spots' of contamination.

Quantum Geotech (2021) conducted soil analysis in August 2021 at all boreholes and most trial pit locations with up to three samples at each location. However, these monitoring locations are located within the wider WRC in the field to the south of the BRC and therefore would not be representative of the BRC soil due to the difference in underlying artificial ground (no Made Ground here) and land use (no assets) as described in further detail in the EQRA. Only BH101 to BH103 are located north of Mere Bank Rhine close to the BRC and Aecom (2021) concluded that soil analysis at these three locations recorded concentrations above the LoD in BH102 (Made Ground) for isopropylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, and 4-isopropyltoluene.

The highest PAH concentrations were recorded within the Made Ground in BH102. The only BTEX and MTBE detections were in BH102 (Made Ground) where ethylbenzene, m & p-xylene, and o-xylene were recorded.

Halcrow (1998) includes an explanation on the soil analysis conducted from samples of the Made Ground (5 samples), superficial deposits (termed alluvium but classified as Tidal Flat Deposits in this report) (18 samples) and highly weathered Mercia Mudstone (2 samples). The raw data for pH and soluble sulphate from these samples is not provided in Halcrow (1998) but the following was included:

- Median pH of Made Ground samples is 7.05;
- Soluble sulphate of Made Ground samples ranged between 0.06 and 0.17 g/l with a median of 0.12 g/l;
- pH of superficial deposits samples had a range of 6.1 to 8.2 and a median of 7.1;
- Soluble sulphate of superficial deposits samples ranged between 0.04 and 0.19 g/l with a median of 0.095 g/l;
- Median pH of Mercia Mudstone samples is 6.85; and
- Soluble sulphate of Mercia Mudstone samples had a maximum of 0.15 g/l with a median of 0.125 g/l.

A table of sample statistics for soil samples is included in Halcrow (1998) and has been replicated in Table 1.1. Halcrow (1998) also concluded that there is elevated boron and zinc at the Site, iron concentrations are raised above natural background concentrations in one sample and there are raised concentrations of oils and grease and cadmium in one sample.

Table 1.1 Summary of Detected Contaminant Concentrations, Halcrow 1998

Determinand	Units	Maximum	Minimum	Mean
Arsenic	mg/kg	26	2	11.9
Selenium	mg/kg	1	1	1.0
Water soluble Boron	mg/kg	8.6	0.4	2.1
Total PAH	mg/kg	62	10	13.9
Total Extractable Oil and Grease	mg/kg	6820	27	250.7
Cyanide	mg/kg	0.9	0.5	0.7
Cadmium	mg/kg	36	1	3.6
Chromium	mg/kg	69	1	30.0
Copper	mg/kg	109	1	11.1
Mercury	mg/kg	1.3	0.1	0.2
Nickel	mg/kg	49	5	27.9
Lead	mg/kg	1650	15	95.6
Zinc	mg/kg	2490	56	339.6
Iron	mg/kg	47900	2900	28697.6
Dried solids	%	96.2	53.3	76.3
Coal Tar-Semi Quantitative	-	650	60	163.5
TPH by IR	-	83.9	25	41.1

Sludge composition data has been provided by Wessex Water based on an average over a period of a year for various assets across the Site including digesters and APDs. However, the only data provided that can be compared to site investigation data at the Site is from the biodrier centrifuge cake. This is detailed in Table 1.2.

The data have been compared to the soil quality data above from the site investigations along with what may be deemed normal background concentrations (BGS, 2022). These comparisons have been made to determine whether there is any evidence that current ground conditions (i.e., baseline conditions at the point of the environmental permit application) have been impacted by sludge / cake at the Site. If the concentrations in the soil are much greater than in the sludge / cake, then the source is unlikely to be from the Site. If the sludge / cake is greater than or equal to the soil, then this might suggest an impact from the Site and so background concentrations should also be considered where this is available. If the sludge / cake and soils are both greater than background concentrations, then this may indicate a possible impact.

Metal concentrations were only provided for the biodrier centrifuge cake, and this has been compared to the site investigation soil data above. Copper concentrations are much higher from the cake compared to the soil samples (an order of magnitude greater) and normal background concentrations. Cake composition data are only provided as an average and therefore no comparison can be made on the range of concentrations. Excluding copper, the concentrations from the cake are of similar magnitude to that of the site investigations.

In summary, concentrations of copper appear to be up to an order of magnitude greater in the cake samples than those in soils and based on normal background. Concentrations of cadmium are also greater in the cake (1.77 mg/kg) and soil (3.6 mg/kg) compared to normal background concentrations (0 – 0.33 mg/kg). The reported normal background concentrations of arsenic and lead in the area are above concentrations reporting in both cake and soils. The concentrations of nickel in cake samples are similar to those measured in soils which in turn, are similar to normal background concentrations. Where background concentrations are not available (for chromium) concentrations in soils do not appear to be particularly elevated. Therefore, there is no strong evidence to suggest that soils have been significantly impacted by historical sewage operations at the Site and it is therefore considered unlikely that contamination has occurred.

Table 1.2 Summary of biodrier centrifuge cake chemical concentrations

Determinand	Unit	Biodrier centrifuge cake
Arsenic	mg/kg	7.35
Cadmium	mg/kg	1.77
Chromium	mg/kg	60.60
Copper	mg/kg	332.35
Iron	mg/kg	16668.50
Lead	mg/kg	81.20
Mercury	mg/kg	0.40
Nickel	mg/kg	42.15
Selenium	mg/kg	2.28
Zinc	mg/kg	836.50

Surface Water Samples

Two surface water samples (one upstream and one downstream of the Site) were taken from Mere Bank Rhine during Quantum Geotech (2021) and were summarised in Aecom (2021). Aecom (2021) noted that the pH became less alkaline as the water passed the Site and measured 7.7 in the upstream sample and 7.3 in the downstream sample. The BOD and COD concentrations remained fairly constant between the samples and in general were lower than the groundwater samples. All other determinands were above the limit of detection (LoD) in at least one sample except for cyanide (Thiocyanite, free, total and complex), sulphide, beryllium, mercury, vanadium, chromium (hexavalent), TPH, PAH and fatty acids. Of all the determinands measured above the LoD, all had increased between the upstream and down stream samples.

Groundwater Samples

Quantum Geotech (2021) conducted water analysis in September/October 2021 at all boreholes. However, these monitoring locations are located within the wider WRC in the field to the south of the BRC and therefore are not deemed to be representative of the BRC due to the presence of Mere Bank Rhine between the locations and the BRC and the difference in land use (no assets) as described in further detail in the EQRA.

Halcrow (1998) explained that groundwater samples were taken during drilling and analysed in 1998. These were compared against UK Drinking Water Standards which revealed that many of the concentrations were found to be elevated. A table of sample statistics for groundwater samples is included in Halcrow (1998) and has been replicated in Table 1.3.

Table 1.3 Summary of Detected Contaminant Concentrations, Halcrow 1998

Determinand	Units	Maximum	Minimum	Mean
Mercury	ug/l	4.46	0.02	0.6
Cyanide	mg/l	0.01	0.01	0
Copper	mg/l	1.7	0.01	0.4
Zinc	mg/l	24	0.03	4.4
Cadmium	mg/l	0.2	0.005	0
Boron	mg/l	2.66	0.2	1.3
Lead	mg/l	19	0.05	3.2
Arsenic	mg/l	0.135	0.005	0
Chromium	mg/l	0.26	0.03	0.1
Selenium	mg/l	0.007	0.002	0
Iron	mg/l	242	0.11	80.7
Nickel	mg/l	0.41	0.003	0.1
Total Extractable Oil and Grease	mg/l	69.3	27.6	48.5
Persistent Mineral Oil	mg/l	3.26	3.17	3.2
Total PAH	mg/l	1	1	1

Wood (2019, 2020 and 2021) are annual reports written for the Site reporting data from six groundwater monitoring wells. Summary data for 2019 is displayed in Table 1.4, 2020 data in Table 1.5 and 2021 data in Table 1.6 which show the minimum and maximum detected concentrations and the locations at which contaminants were detected at. Trigger levels are also calculated in these reports with exceedances sent to the Environment Agency.

Wood (2019) states that aliphatic TPH concentrations in the C5 to C16 carbon range and aromatic TPH in the EC5 to EC35 range were below the LoD (<0.01 mg/l) in all samples. BTEX compounds or MTBE were not detected above the relevant LoDs (<0.001 mg/l to <0.008 mg/l). Cadmium, chromium and mercury were all below their LoDs. WS003 exceeded the trigger levels for chloride, potassium and sodium but are all still below concentrations recorded during the previous monitoring round.

Table 1.4 Summary of Detected Contaminant Concentrations, Wood 2019

Contaminant	Minimum	Maximum	Locations where substance recorded above the LoD
pH	7.63	7.9	N/A
Electrical conductivity	0.79 mS/cm	1.65 mS/cm	All locations (incl. WS002 duplicate)
Hardness (as CaCO ₃)	321 mg/l	707 mg/l	All locations (incl. WS002 duplicate)
Ammoniacal nitrogen	0.95 mg/l	4.63 mg/l	All locations (incl. WS002 duplicate)
Nitrate	0.44 mg/l	22.9 mg/l	WS006, WS007 and duplicate of WS002
Nitrite	0.051 mg/l	0.051 mg/l	WS006
Sulphate	39.2 mg/l	224 mg/l	WS001, WS002, WS005 to WS007 and duplicate of WS002
Phosphate	0.25 mg/l	4.16 mg/l	WS001, WS002, WS003, WS007 and duplicate of WS002
Arsenic	0.00168 mg/l	0.145 mg/l	All locations (incl. WS002 duplicate)
Cadmium	n/a	n/a	None
Chromium	n/a	n/a	None
Copper	0.0005 mg/l	0.00399 mg/l	WS006, WS007
Lead	0.000208 mg/l	0.000386 mg/l	All locations (incl. WS002 duplicate)
Mercury	n/a	n/a	None
Nickel	0.00126 mg/l	0.0089 mg/l	All locations (incl. WS002 duplicate)
Potassium	5.56 mg/l	36.3 mg/l	All locations (incl. WS002 duplicate)
Selenium	0.00153 mg/l	0.00158 mg/l	WS006, WS007
Sodium	73.5 mg/l	242 mg/l	All locations (incl. WS002 duplicate)
Zinc	0.0014 mg/l	0.016 mg/l	All locations (incl. WS002 duplicate)
Aliphatics >C16-C21 (aq)	<0.01 mg/l	0.028 mg/l	WS006
Aliphatics >C21-C35 (aq)	<0.01 mg/l	0.033 mg/l	WS006

Wood (2020) states that aliphatic TPH concentrations in the C5 to C16 carbon range and aromatic TPH in the EC5 to EC35 range were below the LoD (<0.01 mg/l) in all samples. BTEX compounds or MTBE were not detected above the relevant LoDs (<0.001 mg/l to <0.008 mg/l). Total aliphatic and aromatic >C5 to C35 TPH concentrations at WS001 (duplicate sample), WS002 and WS003 were recorded at the LoD but with no individual aliphatic or aromatic carbon band above the LoD. Chromium and mercury were below their LoDs. WS003 exceeded the trigger levels for chloride and sodium. The chloride concentration is below the two previous monitoring results, however the sodium result is similar to its maximum concentration in 2018. WS001 exceeded the trigger level for nitrate for the first time, however its duplicate sample was below.

Table 1.5 Summary of Detected Contaminant Concentrations, Wood 2020

Contaminant	Minimum	Maximum	Locations where substance recorded above the LoD
pH	7.25	7.89	N/A
Electrical conductivity	0.599 mS/cm	1.45 mS/cm	All locations (incl. WS001 duplicate)
Hardness (as CaCO ₃)	300 mg/l	625 mg/l	All locations (incl. WS001 duplicate)

Contaminant	Minimum	Maximum	Locations where substance recorded above the LoD
Ammoniacal nitrogen	1.28 mg/l	3.47 mg/l	All locations (incl. WS001 duplicate)
Nitrate	<0.3 mg/l	27.3 mg/l	WS001 (and its duplicate), WS002, WS006 and WS007
Nitrite	<0.05 mg/l	0.149 mg/l	WS006
Sulphate	<2 mg/l	174 mg/l	WS001, WS002, WS003, WS007 and duplicate of WS001
Phosphate	<0.05 mg/l	3.61 mg/l	WS001, WS002, WS003, WS007 and duplicate of WS001
Arsenic	0.000973 mg/l	0.0609 mg/l	All locations (incl. WS001 duplicate)
Cadmium	<0.00008 mg/l	0.000093 mg/l	WS006
Chromium	<0.001 mg/l	<0.001 mg/l	None
Copper	<0.0003 mg/l	0.00727 mg/l	WS002, WS006
Lead	<0.0002 mg/l	0.000554 mg/l	WS002, WS003, WS006 and WS007
Mercury	<0.00001 mg/l	<0.00001 mg/l	None
Nickel	0.00196 mg/l	0.00814 mg/l	All locations (incl. WS001 duplicate)
Potassium	4.22 mg/l	29.4 mg/l	All locations (incl. WS001 duplicate)
Selenium	<0.001 mg/l	0.00154 mg/l	WS002, WS006
Sodium	28.8 mg/l	258 mg/l	All locations (incl. WS001 duplicate)
Zinc	0.00145 mg/l	0.022 mg/l	All locations (incl. WS001 duplicate)
Aliphatics >C16-C21 (aq)	<0.01 mg/l	0.026 mg/l	WS006
Aliphatics >C21-C35 (aq)	<0.01 mg/l	0.014 mg/l	WS006
Total Aliphatics & Aromatics > C5-35 (aq)	<0.01 mg/l	0.042 mg/l	WS001 (duplicate sample), WS002, WS003 and WS006

Concentrations of aliphatic and aromatic TPH in the C5 to C35 carbon range, BTEX compounds and MTBE were all below the LOD in Wood (2021). Chromium, nitrite, mercury and selenium were below their LoDs. WS001 was above the nitrate trigger level and WS003 exceeded the trigger level for sodium. The nitrate exceedance in WS001 is a similar concentration to that recorded in 2020. The sodium result is comparable to previous results and is slightly below the concentrations recorded in 2018 and 2002.

Table 1.6 Summary of Detected Contaminant Concentrations, Wood 2021

Contaminant	Minimum	Maximum	Locations where substance recorded above the LoD
pH	7.26	7.79	N/A
Electrical conductivity	0.615	1.65	All locations (incl. WS005 duplicate)
Hardness (as CaCO ₃)	307	559	All locations (incl. WS005 duplicate)
Ammoniacal nitrogen	0.973	3.46	All locations (incl. WS005 duplicate)
Nitrate	1.14	2.14	All locations (incl. WS005 duplicate)
Nitrite	<0.05	<0.05	None

Contaminant	Minimum	Maximum	Locations where substance recorded above the LoD
Sulphate	7.9	139	All locations (incl. WS005 duplicate)
Phosphate	0.057	2.29	All locations (incl. WS005 duplicate)
Arsenic	0.000986	0.123	All locations (incl. WS005 duplicate)
Cadmium	<0.00008	0.000216	WS006
Chromium	<0.001	<0.001	None
Copper	<0.0003	0.00306	WS006
Lead	<0.0002	0.000425	WS002, WS003, WS005
Mercury	<0.00001	<0.00001	None
Nickel	0.00111	0.00699	All locations (incl. WS005 duplicate)
Potassium	5.78	30.6	All locations (incl. WS005 duplicate)
Selenium	<0.001	<0.001	None
Sodium	27.1	253	All locations (incl. WS005 duplicate)
Zinc	0.00154	0.0136	All locations (incl. WS005 duplicate)

It should be noted that a great deal of emphasis is placed on the limited chemical data and the reported data shouldn't be assumed to represent groundwater quality at the Site. The chemical data is for samples collected by a third party; sample collection and storage procedures are not known and could affect the validity of the results. Furthermore, chemical concentrations vary spatially and with time.

The laboratory analysis reports are appended to the individual SI Reports, presented as Appendix B to G of this memo (Stantec, 2022).

POTENTIAL SOURCES OF CONTAMINATION (PSCs)

PSCs identified on site and within 50m of the Avonmouth Bioresources Centre (250m for potentially infilled ground) are summarised in Table 1.7 and illustrated in Figure 1. This has been completed by reviewing the site history presented in the EQRA and using information, including historical mapping included in the Environmental Data Report (Groundsure, 2020) and online sources (Data.gov.uk, 2021).

Table 1.7 Potential Sources of Contamination (PSCs)

PSC Plan ID	PSC on site or within 50m radius, 250m radius for potentially infilled land	Distance to site	Status / Year	Potential Contaminants
1	<p>Avonmouth BRC. Infrastructure includes digesters (including food digesters), APDs, strain presses, combined heat plants (CHPs) and boiler including fuel oil storage tank. Potential for infilling of former tanks and infrastructure bases during development of bioresources centre (see EQRA Figure 3.3 For Current Bioresources centre Assets).</p> <p>Made Ground including ash was identified in BH1 and BH2 during the Structural Soils 1991 SI between 0.05 and 2.8m bgl and 0 and 2.3m bgl respectively. Occasional coal fragments were noted in BH3 and BH4 in Foundation Engineering 1980 which are located in the same area as the borehole recording the ash. Norwest Holst 2007 noted in TP2 from 0 to 1m bgl that slag and clinker were present, and this location is in the same area as the boreholes above recording ash and coal which is in the west of the Site.</p>	On-Site	Present	<p>Metals, petroleum hydrocarbons, VOCs including BTEX, MTBE - associated with fuel tank(s) and pumping stations</p> <p>Phenols, PAHs, pathogens, polychlorinated biphenyls (PCBs) (associated with generators and electricity substations),</p> <p>Asbestos and ground gas (carbon dioxide, carbon monoxide, methane, hydrogen sulphide) - from areas of infilling and sewage treatment,</p>
1a	Wider Avonmouth STW. Sewage works and unspecified tanks (PSC 1b) (c.1970) in the south and settling bed to the west. Between 1979 and 1991 an additional lagoon became present to the west of the Site. Between 1991 and 2001, this lagoon split into two smaller water bodies, and it appears the tanks into the northeast corner of the Site have been built over. Potential for infilling of former tanks and infrastructure bases over various phases of redevelopment.	Adjacent	1970's to present	<p>Volatile organic vapours – from storage tanks</p>
1b	<p>Unspecified Tanks</p> <p>Sewage Treatment Works</p>	On-site	<p>1979 -1991, 1970 - 1992</p> <p>1979 -1991</p>	<p>Metals, petroleum hydrocarbons, VOCs, including BTEX, MTBE - associated with fuel tank(s) and pumping stations</p>
1c	Sedimentation Tanks	On site	1970 - 1992	Phenols, PAHs, pathogens, PCBs, ground gas (carbon dioxide, carbon monoxide, methane, hydrogen sulphide) – associated with sludge beds
1d	Electricity Transformer	On-site	1970 / 1970 - 1992	Petroleum Hydrocarbons (heavy fractions) and PCBs.
Landfills within 250m; pollution incidents within 50m (Groundsure, 2020) (Data.gov.uk, 2021)				
3a	Environment Agency Recorded Active or Recent Landfill approximately 10m west of the Site which is operated by Smart Thomas (EA/EPR/EP3298SK/V002) and received industrial waste (Factory curtilage). It has a closed status.			

PSC Plan ID	PSC on site or within 50m radius, 250m radius for potentially infilled land	Distance to site	Status / Year	Potential Contaminants
	Environment Agency Recorded Historical Landfills approximately 10m west of the Site at the same location of the landfill above (L/BL/T/126D – ISC Chemical Limited and L/BL/T/77D – Rhone Poulenc Chemicals Limited) receiving inert and industrial waste. Both landfills had their licenses surrendered on 19/04/1994.			
3b	BGS Recorded Historical Landfill approximately 199m west of the Site on Kings Weston Lane which received 1000 tons of toxic waste.			
3c	Environment Agency Recorded Historical Landfill on-Site at T.Farm which is operated by Bristol Corporation. No further information is available. Environment Agency Recorded Historical Landfill approximately 60m west of the Site on Kings Weston Lane operated by ISC Chemicals, first recorded on 31/12/1964. No further information is available. Environment Agency Recorded Historical Landfill approximately 200m south-west of the Site on Kingsweston Lane. No further information is available. Environment Agency Recorded Historical Landfill approximately 250m north-west of the Site on Kings Weston Lane operated by R T Z Estates, first recorded on 31/12/1956 and last recorded on 31/12/1964. No further information is available.			
4	Pollution incident recorded on site on 18/09/2001 which caused a minor impact to water with a pollutant description of sewage materials – sludge. The list of pollution incidents below were recorded on-site but with no identified impact to water, land or air: <ul style="list-style-type: none">15/05/2002 – oils and fuel02/04/2003 – sewage materials, final effluent06/02/2002 – sewage materials, storm sewage02/04/2003 – general biodegradable materials and wastes The list of pollution incidents below were recorded off-site with the corresponding impacts noted: <ul style="list-style-type: none">13/05/2002 - general biodegradable materials and wastes - minor impact to land – 6m south-west of the Site17/07/2003 – sewage materials, crude sewage – no impact – 11m south-east of the Site28/08/2001 – sewage materials, process effluent – significant impact to water – 15m south-west of the Site19/10/2001 – specific waste materials, asbestos – no impact – 16m north-east of the Site			
British Geological Survey (BGS) Online Records (artificial ground within 250m)				
5	Made Ground (Undivided) Artificial Deposit present on-site (centre area to the north of Mere Bank Rhine) and extending off-site to the west where the three lagoons/ponds are located.			
6	Made Ground (Undivided) Artificial Deposit present approximately 30 m to 240 m off-site, including along the M5, M49, railway line to the north and east and the current trading estate to the south-west.			
7	Worked Ground (Undivided) Voids present on-site beneath the current western lagoons, the historic lagoons in the north-east corner and the south-east corner to the north of Mere Bank Rhine.			
Environmental Permitting / Exemptions (50m radius) (Groundsure, 2020)				
N/A	Six Environmental Permits held at the Site by Wessex Water Services Ltd and Wessex Water Enterprises Limited for Household, Commercial & Industrial Waste Transfer Station, sewage sludge treatment and biological treatment facility. Environmental Permit at Kingspan Insulation Ltd for 75kte HCl Waste TS + treatment. Two Environmental Permits at Kingsweston Lane Civic Amenity Site for household waste amenity site.			

PSC Plan ID	PSC on site or within 50m radius, 250m radius for potentially infilled land	Distance to site	Status / Year	Potential Contaminants
N/A	<p>Six waste exemptions are held at T J Transport Ltd on-site for using, treating and storing waste.</p> <p>Avonmouth Household Waste Recycling Centre hold three waste exemptions for using, treating and storing waste.</p> <p>Bristol Waste Water Treatment Works hold a waste exemption on-site for storing waste.</p> <p>A further storing waste exemption is held at Kingsweston Lane on-site</p>			

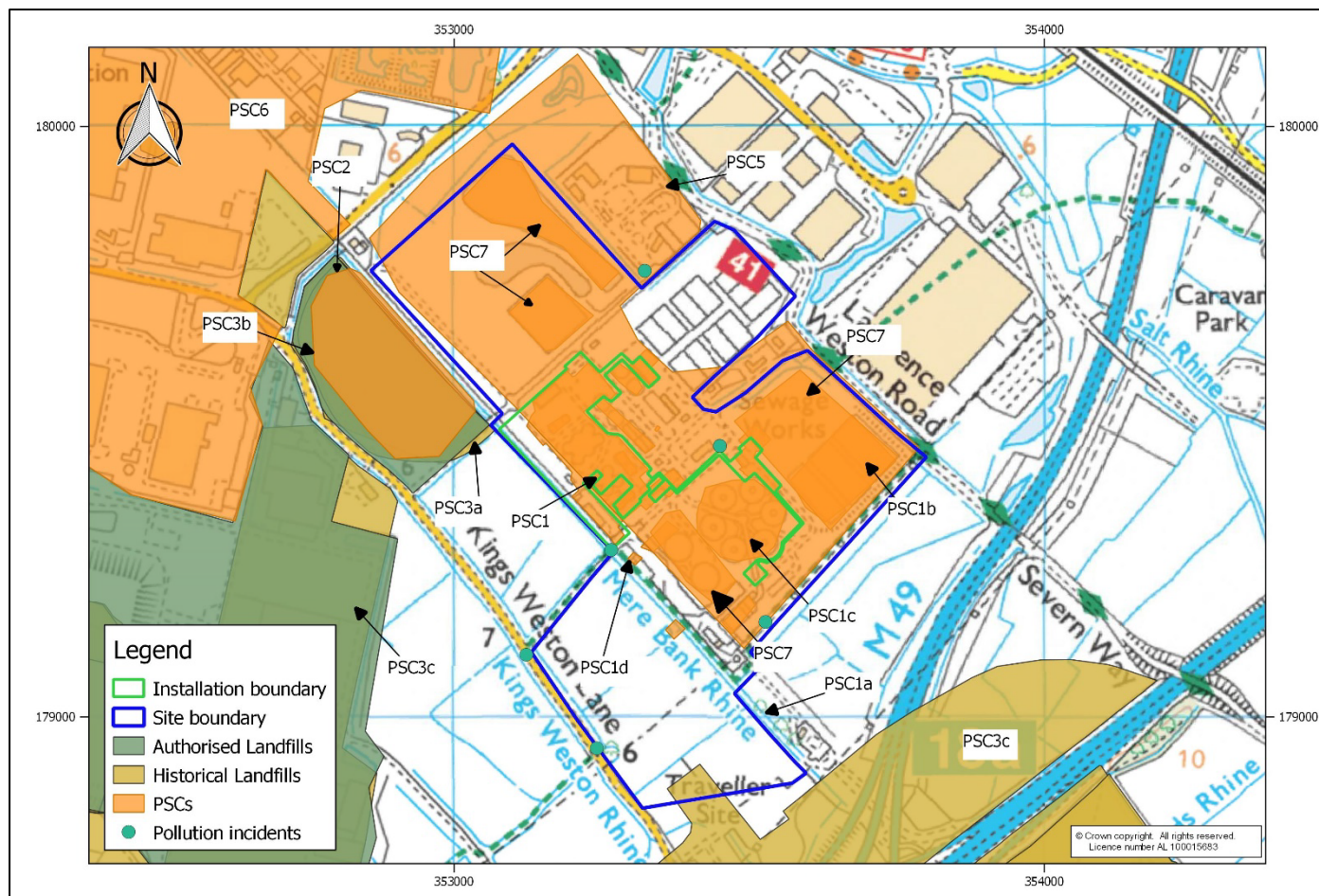


Figure 1 Potential Sources of Contamination (PSC) Plan

RECOMMENDATIONS FOR BASELINE DATA

A number of potential sources of contamination (PSCs) have been identified on Site. As presented in Table 1.7, there are potential contaminants (predominantly metals and hydrocarbons) associated with both the Bioresources Centre activities at the Site and the wider STW. There is limited data for soil and groundwater within the Bioresources Centre to determine baseline data and so it is recommended that further site investigation is undertaken to provide a more comprehensive baseline.

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QUALITY ASSURANCE

Version 1 Author: Elizabeth Wilson Checker: Rob Gordon Reviewer: Peter Duncan	
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Appendix A – Data Tables

Table A1 Historical Groundwater Quality Analysis

Wood 2019					
Exploratory Hole ID	Sample Depth	Strata	General Inorganics	Metals	TPHCWG, MTBE and BTEX
WS001	-	-	x	x	x
WS002	-	-	x	x	x
WS003	-	-	x	x	x
WS004	-	-	x	x	x
WS005	-	-	x	x	x
WS006	-	-	x	x	x
WS007	-	-	x	x	x
Wood 2020					
Exploratory Hole ID	Sample Depth	Strata	General Inorganics	Metals	TPHCWG, MTBE and BTEX
WS001	-	-	x	x	x
WS002	-	-	x	x	x
WS003	-	-	x	x	x
WS004	-	-	x	x	x
WS005	-	-	x	x	x
WS006	-	-	x	x	x
WS007	-	-	x	x	x
Wood 2021					
Exploratory Hole ID	Sample Depth	Strata	General Inorganics	Metals	TPHCWG, MTBE and BTEX
WS001	-	-	x	x	x
WS002	-	-	x	x	x
WS003	-	-	x	x	x
WS004	-	-	x	x	x
WS005	-	-	x	x	x
WS006	-	-	x	x	x
WS007	-	-	x	x	x

TPH CWG - Total Petroleum Hydrocarbons Criteria Working Group; BTEX - Benzene Toluene Ethylbenzene and Xylene.

Appendix B – Quantum Geotech, 2021

Appendix C – Aecom, 2021

Appendix D – Halcrow, 1998

Appendix E – Wood, 2019

Appendix F – Wood, 2020

Appendix G – Wood, 2021