TECHNICAL NOTE

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Project Title	Shoreham Soldiers Point Geo-Environmental Summary
Subject	Review of Ground Investigation Findings
Client	Environment Agency

Document Control

1.0	Geo-Environmental Summary	24/06/2024	RB	MM	MM
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1 Background

JBA Consulting (JBA) have been instructed by the Environment Agency to review the findings of a ground investigation undertaken at Soldiers Point, Shoreham. The ground investigation specification was produced by JBA following recommendations made within an earlier JBA Geo-environmental desk study (ISU-JBAU-XX-XX-RP-EN-0008-A3-C01-Contaminated_Land_Desk_Study).

This technical note provides a summary of the findings of the ground investigation in relation to potential issues associated with historic land contamination and the planned improvements of the Soldiers Point flood risk management assets.

2 Ground Investigations

2.1 Description of Fieldworks

The site is located on land to the north of Shoreham Fort, in Shoreham, situated at the mouth of the River Adur at an approximate National Grid Reference of 523251, 104866 and accessed off Harbour way via Shoreham Sailing Club. The River Adur lies on the northern and eastern site boundaries.

The Ground Investigation was undertaken on April 24th 2024 by Geotechnics Limited. All fieldwork was carried out in accordance with BS 5930:2015+A1 (2020), BS EN 1997-2 (2007) and BS EN ISO 22475-1 (2021). In accordance with the specification the Ground Investigation (GI) comprised excavation of six (6no.) hand dug trial pits (HP101,102,103,104,105, and 106) along, or local to, the alignment of the proposed works on the beach.

The following environmental laboratory tests were scheduled on samples recovered during the GI:

- 4no soils analysis for a range of metallic, hydrocarbon (PAH, and TPH) and inorganic contaminants.
- 4no WAC (Waste Acceptance Criteria) Tests.
- 4no CEFAS MMO Analysis Tests.

The analysis results have been reviewed against the following criteria where relevant:

- The LQM/CIEH S4ULs for Human Health Risk Assessment, 2015, (Nathanial, C.P., McCaffrey, C., Gillett, A.G., Ogden, R. C. and Nathanial, J. F. Publication number: S4UL3382).
- Guidance on the classification and assessment of waste (1st edition V1.2GB, 2021), Technical Guidance WM3, (EA, SEPA, and Natural Resources Wales).
- Cefas Action Levels (ALs) 1 and 2 for beach sediments as per Table 2-1 below.

Table 2-1: CEFAS Action Levels Table

Contaminant / Compound	Action Level 1	Action Level 2
	mg/kg Dry Weight (ppm)	mg/kg Dry Weight (ppm)
Arsenic	20	70
Mercury	0.25	1.5
Cadmium	0.4	4
Chromium	50	370
Copper	30	300
Nickel	30	150
Lead	50	400
Zinc	130	600
Organotins; TBT DBT MBT	0.1	0.5
PCBs, sum of ICES 7	0.01	0.09
PCBs, sum of 25 congeners	0.02	0.18
***DDT**	*0.001	
***Dieldrin**	*0.005	
PCB28	0.0006	0.0017
PCB52	0.0009	0.0027
PCB101	0.001	0.003
PCB118	0.0002	0.0006
PCB138	0.0026	0.0049
PCB153	0.13	0.04
PCB180	0.004	0.012
PAH_THC	0	0
PAH_LMW	0.552	3.16
PAH_HMW	1.7	9.6
BDE28	0.038	0.11
BDE47	0.033	0.0975
BDE66	0.033	0.0975
BDE85	0.0003	0.001
BDE99	0.0003	0.001
BDE100	0.0003	0.001
BDE153	0.367	1.1
BDE154	0.367	1.1

BDE183	4.666	14
BDE209	0.016	0.0475

2.1.1 GI Findings

The ground investigation consisted of six trial pits dug to a maximum depth of 0.9mbgl. Soils encountered within the trial pits are described within the GI Contractor's factual report as comprising natural beach deposits encountered to a maximum depth of 0.9m (base of excavation). The soils are described as orangish brown very gravelly fine to coarse sand for the first 0mbgl-0.3mbgl, below which are darker grey mottled black/dark brown slightly silty slightly organic sand. In HP102, between 0.6mbgl-0.9mnbgl deposits were described as blackish dark grey very sandy slightly silty slightly organic gravel. No Made Ground was encountered.

The trial pit logs provided by the Contractor within their factual report were reviewed for records of visual or olfactory evidence of contamination encountered during the ground investigation works. There was no record of visual or olfactory evidence in any of the trial pits.

3 Laboratory Analysis of Soil Samples

4No. Suite E (Heavy Metals, PAHs and TPHs) 4No WAC tests and 4no CEFAS analyses were carried out on samples recovered from the trial pits by the GI Contractor. A summary of the results obtained is presented below.

3.1 Soils Analysis

Four soil samples were recovered and submitted for laboratory chemical (environmental) analysis for a broad range of potential contaminants including heavy metals and hydrocarbons (PAHs and TPH). The results have initially been compared to the LQM Public Open Space 1 S4UL criteria to evaluate their significance. All analysis results were below the LQM S4UL screening values. Levels of hydrocarbons (PAHs and TPH fractions) were below their respective analysis detection limits.

Screening for the possible presence of Asbestos was undertaken in samples recovered from all four trial pits. No evidence of Asbestos Containing Materials was detected in any trial pit samples.

While there are no screening criteria for Cyanide levels all four samples were below the detectible limit during analysis.

Table 3-1: Summary of Heavy Metal Concentrations in Soils and comparison to LQM Suitable for use Levels for Heavy Metals

Determinand	Concentration range (mg/kg)	LQM S4ULs POS1 (park) (mg/kg)	Number of S4UL Exceedances	Location of Max Recorded Concentration
Arsenic	3.8-9.4	79	None	HP106
Cadmium	<0.1	120	None	-
Copper	1.3-3.7	12000	None	HP105
Chromium	3.2-9.7	1500	None	HP105
Chromium IV	-	7.7	None	
Lead	2.7-56	-	None	HP105
Mercury	<0.05	120	None	-
Nickel	2-4.7	230	None	HP105
Zinc	8-16	81000	None	HP105, HP106

Table 3-2: Summary of PAH Concentrations in Soils and comparison to LQM Suitable for use Levels for PAH

Determinand	Concentration range (mg/kg)	LQM S4ULs POS1 (park) (mg/kg)	Number of Exceedances	Location of Max Recorded Concentration
Naphthalene	<0.1	4900	-	-
Acenaphthylene	<0.1	15000	-	-
Acenaphthene	<0.1	15000	-	-
Fluorene	<0.1	9900	-	-
Phenanthrene	<0.1	3100	-	-
Anthracene	<0.1	74000	-	-
Fluoranthene	<0.1	3100	-	-
Pyrene	<0.1	7400	-	-
Benzo(a)anthracene	<0.1	29	-	-
Chrysene	<0.1	57	-	-
Benzo(b)fluoranthene	<0.1	7.2	-	-
Benzo(k)fluoranthene	<0.1	190	-	-
Benzo(a)pyrene	<0.1	5.7	-	-
Indeno(1,2,3-c,d)pyrene	<0.1	82	-	-
Dibenzo(a,h)anthracene	<0.1	0.58	-	-
Benzo(g,h,i)perylene	<0.1	640	-	-
PAH Total	<2	-	-	-

Table 3-3: Summary of TPH Concentrations in Soils and comparison to LQM Suitable for use Levels for TPH

Determinand	Concentration range (mg/kg)	LQM S4ULs POS1 (park) (mg/kg)	Number of Exceedances	Location of Max Recorded Concentration
Aliphatic C5-C6	<0.05	600000	-	-
Aliphatic C6-C8	<0.1	620000	-	-
Aliphatic C8-C10	<0.05	13000	-	-
Aliphatic C10-C12	<2	13000	-	-
Aliphatic C12-C16	<1	13000	-	-
Aliphatic C16-C21	<2	250000	-	-
Aliphatic C21-C35	<3	250000	-	-
Aliphatic C5-C35		-	-	-
Aromatic C5-C7	<0.05	56000	-	-
Aromatic C7-C8	<0.05	56000	-	-
Aromatic C8-C10	<0.05	5000	-	-
Aromatic C10-C12	<0.25	5000	-	-
Aromatic C12-C16	<1	5000	-	-
Aromatic C16-C21	<2	3800		-
Aromatic C21-C35	<2	3800	-	-
Aromatic C5-C35	-	-	-	-
TPH Ali/Aro Total C5-C35	-	-	-	-

3.2 Waste Acceptance Criteria (WAC Tests)

WAC Tests were undertaken on soil samples. From the following locations named above the results are as follows:

- For all samples values exceed the Stable Non-Reactive Hazardous Waste (SNRHW) limit.
- At HP101 most of the leachable parameter values sit below the limit for inert waste except for Chloride and Total Dissolved Solids. Both exceed the Inert Waste limit however do not exceed the SNRHW limit value.
- At HP102 most of the leachable parameter values sit below the limit for Inert Waste except for Chloride, Total Dissolved Solids and Molybdenum. All exceed the Inert Waste limit however do not exceed the SNRHW limit value.
- At HP103 and HP104 all the leachable parameter values sit below the limit for inert waste except for Chloride. Both exceed the inert waste limit however do not exceed the SNRHW limit value.

3.3 CEFAS Analysis

Heavy metals, PAHs, PCBs and other organic compounds from all four samples (HP101, HP102, HP103, HP106) were compared with CEFAS Levels 1 and 2. There were no exceedances of CEFAS Action Level 1 (or Action Level 2) in any of the four samples.

4 Conclusions and Recommendations

Trial pit logs show that the near surface materials comprise natural beach deposits, with no evidence of Made Ground, or visual/olfactory evidence of contamination noted within the Contractor's logs.

Laboratory analysis of recovered soil samples taken from the trial pits identified low levels of contamination below their respective published screening criteria (S4ULs) for heavy metals, PAHs and TPHs. All the CEFAS analysis of recovered samples gave results less than the Action Level 1 values.

Based upon the findings of the ground investigation it can be reasonably be concluded that the likelihood of encountering contamination during the planned works is low. Trial pit logs indicate that the deposits are predominantly natural in nature and levels of contamination revealed by laboratory analysis are generally low and below relevant published guideline levels.

While the findings of this assessment indicate a low likelihood of encountering contamination during future planned works its presence cannot entirely be ruled out. Therefore, a watching brief should be maintained during the construction phase of the works and the works contractor should anticipate for any Made Ground and/or any unexpected contaminants during the enabling/earthworks in their construction phase plan and RAMS.

Analysis of Waste Acceptance Criteria testing did identify exceedances in leachable parameters Chloride, Molybdenum and Total Dissolved Solids above that of the inert waste limit but below the limit SNRHW. All four samples did exceed the Leachable parameter value of SNRHW for pH. If soils are to be removed from site and disposed of as part of the planned works additional soil testing may be necessary to determine the appropriate treatment or disposal route.