



# XLINKS' MOROCCO-UK POWER PROJECT

## Environmental Statement

### Volume 3, Appendix 8.3: Sediment Sample Chemistry Results

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## XLINKS' MOROCCO – UK POWER PROJECT

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**Prepared by:**

**WSP**

**Prepared for:**

**Xlinks 1 Limited**

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## Glossary

Term	Meaning
Environmental Impact Assessment	The process of identifying and assessing the significant effects likely to arise from a project. This requires consideration of the likely changes to the environment, where these arise as a consequence of a project, through comparison with the existing and projected future baseline conditions.
Offshore Cable Corridor	The proposed corridor within which the onshore High Voltage Direct Current (HVDC) Cables would be located.
The Project (Xlinks' Morocco- UK Power Project)	The overall scheme from Morocco to the national grid, including all onshore and offshore elements of the transmission network and the generation site in Morocco (referred to as the 'Project').
Proposed Development	The element of Xlinks' Morocco-UK Power Project within the UK. The Proposed Development covers all works required to construct and operate the offshore cables (from the UK Exclusive Economic Zone to Landfall), Landfall, onshore Direct Current and Alternating Current cables, converter stations, and road upgrade works.

## Acronyms

Acronym	Meaning
DVV	Double Van-Veen (Grab Sampler)
ES	Environmental Statement
HVDC	High Voltage Direct Current
ISQG	Interim Sediment Quality Guideline
PEL	Probable Effects Level
TEL	Threshold Effects Level

# 1 SEDIMENT SAMPLE CHEMISTRY RESULTS

## 1.1 Introduction

- 1.1.1 This document forms Volume 1, Appendix 8.3: Sediment Sample Chemistry Results of the Environmental Statement (ES) prepared for the United Kingdom (UK) elements of Xlinks' Morocco UK Power Project (the 'Project'). For ease of reference, the UK elements of the Project are referred to as the 'Proposed Development', which is the focus of the ES. The ES presents the findings of the Environmental Impact Assessment process for the Proposed Development.
- 1.1.2 The purpose of this appendix is to present the results of chemical laboratory analysis undertaken on sediment grab samples collected from 51 stations along the Offshore Cable Corridor.
- 1.1.3 The majority of stations were sampled with a DVV grab ( $2 \times 0.1 \text{ m}^2$ ) with stations with coarser sediments sampled with a  $0.01 \text{ m}^2$  mini-Hamon grab. The locations of the grab stations can be found on Volume 3, Figure 8.8: Locations of Sediment Data of the ES.
- 1.1.4 The sediment particle size analysis is summarised in Volume 3, Appendix 8.1 Sediment Source Concentrations and Assessment of Disturbance of the ES. Typically, the sediments along the Offshore Cable Corridor are classified as 'Very Fine' to 'Medium' sands, with median particle size ( $d_{50}$ ) values between 0.07 mm and 0.47 mm.
- 1.1.5 The sediment samples were analysed for metals and Polycyclic Aromatic Hydrocarbons (PAHs) with results presented in this Appendix. Results are compared to Sediment Quality Guidelines (SQGs), namely Cefas 'Action Level' 1 and 2 (gov.uk, 2023) and Interim Sediment Quality Guidelines (ISQGs) / Threshold Effects Levels (TELs) and Probable Effects Levels (PELs), from CCME (1999).
- 1.1.6 The Cefas Action Levels are used to determine the contaminant loading of a material - generally used as part of a 'weight of evidence' approach to assessing dredged material and its suitability for disposal to sea. Below Action Level 1, contaminant levels are generally considered to be of no concern and, above Action Level 2, materials are considered to be unsuitable for disposal at sea.
- 1.1.7 The TEL and PEL approach consider the sediment contamination concentration at which a toxic response is observed in benthic organisms. For the TEL, a toxic response has started to be observed. For the PEL, a large percentage of benthic organisms will show a toxic response.
- 1.1.8 A discussion of the sediment chemistry results is included in Chapter 8: Physical Processes of the ES.

## MUPP Xlinks Sediment Sample Chemistry Results

Comparison to CEFAS Action Levels

Heavy & Trace Metals	Unit	Action Level 1 (mg/kg)	Action Level 2 (mg/kg)	UK_01	UK_02	UK_03	UK_04	UK_05	UK_06	UK_07	UK_09	UK_10	UK_11	UK_13	UK_14	UK_15	UK_16	UK_17	UK_18	UK_19	UK_20	UK_21	UK_23	UK_24	UK_27	UK_30	UK_31	
Arsenic (As)	mg/kg	20	100	5.5	5.5	6.7	7.1	4.2	3.5	3.2	2.4	3.1	2.1	4.6	2.6	2.5	5.1	5.9	4.3	2.4	4.5	17.8	9.5	8.7	18.5	9.3	12.6	
Cadmium (Cd)	mg/kg	0.4	5	0.08	0.04	0.05	0.08	0.07	0.08	0.06	0.10	0.07	0.14	0.10	0.14	0.06	0.08	0.10	0.09	0.12	0.07	0.09	0.04	0.06	0.07	0.10		
Chromium (Cr)	mg/kg	40	400	5.2	8.0	10.6	10.7	8.5	8.7	6.3	7.7	9.0	7.5	9.1	9.3	8.2	5.7	8.2	6.6	8.1	7.9	6.4	5.8	7.6	5.8	4.4	6.5	
Copper (Cu)	mg/kg	40	400	1.9	1.2	1.4	1.4	1.7	2.3	1.4	2.4	2.3	2.6	2.8	7.1	2.7	11	1.5	1.7	4.3	2.4	1.5	1.3	2.5	1.4	1.1	2.1	
Mercury (Hg)	mg/kg	0.3	3	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02	0.03	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.01	0.02	
Nickel (Ni)	mg/kg	20	200	4.0	4.5	5.7	5.6	5.1	5.5	4.3	5.6	5.6	7.0	7.2	6.5	4.3	5.1	5.4	10.8	6.1	6.6	4.3	7.3	5.1	4.1	5.7		
Lead (Pb)	mg/kg	50	500	4.4	4.6	7.8	5.3	4.8	5.3	4.2	4.9	4.5	3.8	6.9	5.3	4.8	3.4	5.5	5.8	6.1	6.1	13.9	9.8	5.5	11.5	7.1	10.6	
Heavy & Trace Metals	Unit	Action Level 1 (mg/kg)	Action Level 2 (mg/kg)	UK_33	UK_34	UK_35	UK_36	UK_37	UK_38	UK_39	UK_40	UK_41	UK_42	UK_43	UK_44	UK_45	UK_46	UK_51	UK_52	UK_53	UK_54	UK_55	UK_56	UK_57	UK_58	UK_59	UK_61	
Arsenic (As)	mg/kg	20	100	17.2	12.2	10.9	9.4	15.0	9.3	10.0	11.5	14.0	16.6	19.1	20.6	18.7	38.7	23.2	23.1	40.0	40.6	34.4	24.2	12.6	13.8	17.2	16.4	
Cadmium (Cd)	mg/kg	0.4	5	0.06	0.07	0.09	0.10	0.09	0.05	0.06	0.04	0.06	0.05	0.05	0.05	0.04	0.06	0.04	0.05	0.04	0.04	0.08	0.09	0.08	0.07	0.07		
Chromium (Cr)	mg/kg	40	400	5.9	9.4	5.4	5.4	10.1	6.1	5.9	6.7	8.1	7.3	8.5	7.2	6.8	6.9	7.1	13.5	8.4	9.7	10.2	10.6	12.9	12.8	13.2	13.4	
Copper (Cu)	mg/kg	40	400	2.3	3.8	1.3	1.8	4.1	1.7	1.1	1.5	1.5	1.8	2.3	2.2	2.6	3.0	4.6	9.0	3.9	4.9	4.4	4.2	7.0	7.8	7.9	6.5	
Mercury (Hg)	mg/kg	0.3	3	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05	0.04	0.04	0.05	0.09	0.07	0.05		
Nickel (Ni)	mg/kg	20	200	10.7	12.7	5.0	5.1	9.8	4.1	4.0	5.1	4.6	5.7	7.4	5.9	5.6	10.0	11.4	16.8	12.7	14.8	14.4	14.4	14.9	15.6	17.8	18.3	
Lead (Pb)	mg/kg	50	500	10.1	7.1	5.4	6.3	6.0	5.8	4.4	6.2	7.0	8.1	9.1	10.7	11.8	12.5	15.8	13.3	19.0	19.2	17.9	18.5	19.7	19.3	18.0		
PAH	Unit	Action Level 1 (µg/kg)	Action Level 2 (µg/kg)	UK_01	UK_02	UK_03	UK_04	UK_05	UK_06	UK_07	UK_09	UK_10	UK_11	UK_13	UK_14	UK_15	UK_16	UK_17	UK_18	UK_19	UK_20	UK_21	UK_23	UK_24	UK_27	UK_30	UK_31	
Acenaphthene	µg/kg	100	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.96	<1	<1	<1	<1	<1	<1	<1	
Acenaphthylene	µg/kg	100	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		
Anthracene	µg/kg	100	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.69	<1	<1	<1	3.23	<1	<1	<1	<1	<1		
Benz(a)anthracene	µg/kg	100	-	<1	<1	<1	<1	2.94	<1	<1	3.50	<1	3.84	1.70	2.97	4.55	<1	<1	<1	9.62	3.38	<1	<1	2.20	<1	<1	<1	
Benz(a)pyrene	µg/kg	100	-	<1	<1	<1	<1	1.48	2.78	2.01	<1	4.26	2.25	4.91	2.37	3.31	5.36	<1	<1	10.82	3.53	<1	<1	2.22	<1	<1	<1	
Benz(b)fluoranthene	µg/kg	100	-	<1	<1	<1	<1	1.67	3.67	5.46	1.85	11.83	7.15	13.33	8.92	11.07	13.25	2.90	1.60	2.03	25.00	8.16	21.0	21.5	4.53	2.33	<1	2.35
Benz(g,h,i)perylene	µg/kg	100	-	<1	<1	<1	<1	2.03	2.27	3.58	<1	5.95	4.08	6.72	4.35	5.28	7.06	1.40	<1	13.40	4.33	<1	<1	2.55	<1	<1	<1	
Benz(e)pyrene	µg/kg	100	-	<1	<1	<1	<1	3.00	3.55	<1	9.03	5.25	9.34	7.47	10.35	1.96	<1	<1	17.39	5.90	1.49	1.51	3.21	1.56	<1	1.55		
Benz(k)fluoranthene	µg/kg	100	-	<1	<1	<1	<1	3.00	3.55	<1	1.48	2.78	2.01	4.26	2.25	4.91	2.37	3.31	5.36	<1	<1	10.82	3.53	<1	<1	2.22	<1	<1
C1-Naphthalenes	µg/kg	100	-	<1	<1	<1	<1	3.16	2.58	<1	6.80	4.13	7.60	5.42	3.93	8.10	2.51	<1	1.56	22.64	6.00	21.9	2.62	4.61	2.98	1.57	4.22	
C1-178	µg/kg	100	-	<1	<1	<1	<1	1.47	2.11	2.88	<1	7.47	3.88	7.20	5.09	16.14	8.28	2.05	<1	<1	20.41	5.85	21.9	2.36	4.83	2.88	<1	3.47
C2-Naphthalenes	µg/kg	100	-	<1	<1	<1	<1	2.93	3.20	<1	7.43	4.45	7.09	5.26	31.64	7.77	21.2	<1	<1	19.36	5.90	1.74	2.43	4.23	3.03	1.41	3.68	
C3-Naphthalenes	µg/kg	100																										

**MUPP Xlinks Sediment Sample Chemistry Results**  
Comparison to CCME TEL/PEL levels

Heavy & Trace Metals	Unit	ISQG/TEL (mg/kg)	PEL (mg/kg)	UK_01	UK_02	UK_03	UK_04	UK_05	UK_06	UK_07	UK_09	UK_10	UK_11	UK_13	UK_14	UK_15	UK_16	UK_17	UK_18	UK_19	UK_20	UK_21	UK_23	UK_24	UK_27	UK_30	UK_31
Arsenic (As)	mg/kg	7.24	41.6	55	55	6.7	7.1	4.2	3.5	3.2	2.4	3.1	2.1	4.6	2.6	2.5	5.1	5.9	4.3	2.4	4.5	17.8	9.5	8.7	18.5	9.3	12.6
Cadmium (Cd)	mg/kg	0.7	4.2	0.08	0.04	0.05	0.08	0.07	0.08	0.06	0.10	0.07	0.14	0.10	0.14	0.06	0.08	0.10	0.09	0.12	0.07	0.09	0.04	0.06	0.07	0.10	
Chromium (Cr)	mg/kg	52.3	160	52	8.0	10.6	10.7	8.5	8.7	6.3	7.7	9.0	7.5	9.1	9.3	8.2	5.7	8.2	6.6	8.1	7.9	6.4	5.8	7.6	5.8	4.4	6.5
Copper (Cu)	mg/kg	18.7	108	19	12	14	14	17	23	14	24	23	26	28	71	27	11	15	17	43	24	15	13	25	14	11	21
Mercury (Hg)	mg/kg	0.13	0.7	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02	0.03	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.01	0.02	
Nickel (Ni)	mg/kg	16	43	4.0	4.5	5.7	5.6	5.1	5.5	4.3	5.6	5.6	7.0	7.2	6.5	4.3	5.1	5.4	10.8	6.1	6.6	4.3	7.3	5.1	4.1	5.7	
Lead (Pb)	mg/kg	30.2	112	44	4.6	7.8	5.3	4.8	5.3	4.2	4.9	4.5	3.8	6.9	5.3	4.8	3.4	5.5	5.8	6.1	13.9	9.8	5.5	11.5	7.1	10.6	
Heavy & Trace Metals	Unit	ISQG/TEL (mg/kg)	PEL (mg/kg)	UK_33	UK_34	UK_35	UK_36	UK_37	UK_38	UK_39	UK_40	UK_41	UK_42	UK_43	UK_44	UK_45	UK_46	UK_51	UK_52	UK_53	UK_54	UK_55	UK_56	UK_57	UK_58	UK_59	UK_61
Arsenic (As)	mg/kg	7.24	41.6	17.2	12.2	10.9	9.4	15.0	9.3	10.0	11.5	14.0	16.6	19.1	20.6	18.7	38.7	23.2	23.1	40.0	40.6	34.4	24.2	12.6	13.8	17.2	16.4
Cadmium (Cd)	mg/kg	0.7	4.2	0.06	0.07	0.09	0.10	0.09	0.05	0.06	0.04	0.06	0.05	0.05	0.04	0.06	0.04	0.05	0.04	0.04	0.08	0.09	0.08	0.07	0.07	0.07	
Chromium (Cr)	mg/kg	52.3	160	59	9.4	5.4	5.4	10.1	6.1	5.9	6.7	8.1	7.3	8.5	72	6.8	6.9	7.1	13.5	8.4	9.7	10.2	10.6	12.9	12.8	13.2	13.4
Copper (Cu)	mg/kg	18.7	108	23	3.8	13	1.8	4.1	17	11	1.5	1.5	1.8	2.3	2.2	2.6	3.0	4.6	9.0	39	4.9	4.4	7.0	7.8	7.9	6.5	
Mercury (Hg)	mg/kg	0.13	0.7	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05	0.04	0.04	0.04	0.05	0.09	0.09	0.07	0.05	
Nickel (Ni)	mg/kg	16	43	10.7	12.7	5.0	5.1	4.1	4.0	5.1	4.6	5.7	7.4	5.9	5.6	10.0	11.4	16.8	12.7	14.8	14.4	14.4	14.9	15.6	17.8	18.3	
Lead (Pb)	mg/kg	30.2	112	10.1	7.1	5.4	6.3	6.0	5.8	4.4	6.2	7.0	8.1	9.1	10.7	11.8	12.5	15.8	13.3	19.0	19.2	17.9	17.8	18.5	19.7	19.3	18.0
PAH	Unit	ISQG/TEL (µg/kg)	PEL (µg/kg)	UK_01	UK_02	UK_03	UK_04	UK_05	UK_06	UK_07	UK_09	UK_10	UK_11	UK_13	UK_14	UK_15	UK_16	UK_17	UK_18	UK_19	UK_20	UK_21	UK_23	UK_24	UK_27	UK_30	UK_31
Acenaphthene	µg/kg	6.71	889	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	296	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	µg/kg	5.87	128	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Anthracene	µg/kg	46.9	245	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.69	<1	<1	<1	323	<1	<1	<1	<1	<1	<1	<1
Benz(a)anthracene	µg/kg	74.8	693	<1	<1	<1	<1	294	<1	<1	3.50	<1	3.84	1.70	2.97	4.55	<1	<1	9.62	3.38	<1	<1	2.20	<1	<1	<1	
Benz(a)pyrene	µg/kg	88.8	763	<1	<1	<1	1.48	2.78	2.01	<1	4.26	2.25	4.91	2.37	3.31	5.36	<1	<1	10.82	3.53	<1	<1	2.22	<1	<1	<1	
Benz(b)fluoranthene	µg/kg	-	-	<1	<1	<1	1.67	3.67	5.46	1.85	11.83	7.15	13.33	8.92	11.07	13.25	2.90	1.60	2.03	25.00	8.16	210	215	4.53	2.33	<1	2.35
Benz(g,h,i)perylene	µg/kg	-	-	<1	<1	<1	<1	2.33	4.67	<1	9.58	6.25	11.26	7.49	8.82	10.99	2.04	<1	1.85	18.33	6.01	1.40	1.59	3.00	1.59	<1	1.56
Benz(e)pyrene	µg/kg	-	-	<1	<1	<1	<1	2.03	2.27	3.58	<1	5.95	4.08	6.72	4.35	5.28	7.06	1.40	<1	13.40	4.33	<1	<1	2.55	1.37	<1	<1
Benz(k)fluoranthene	µg/kg	-	-	<1	<1	<1	<1	3.00	3.55	<1	9.03	5.25	9.34	7.47	10.35	1.96	<1	17.39	5.90	1.49	1.51	3.21	1.56	<1	1.55		
C1-Naphthalenes	µg/kg	34.6	391	<1	<1	<1	316	<1	258	<1	6.80	4.13	7.60	5.42	31.93	8.10	2.51	<1	1.56	22.64	6.00	2.19	2.62	4.61	2.98	1.57	4.22
C1-178	µg/kg	-	-	<1	<1	<1	1.47	2.11	2.88	<1	7.47	3.88	7.20	5.09	16.14	8.28	2.05	<1	20.41	5.85	219	236	4.83	2.88	<1	3.47	
C2-Naphthalenes	µg/kg	34.6	391	<1	<1	<1	293	<1	320	<1	7.43	4.45	7.09	5.26	31.64	7.77	2.12	<1	19.36	5.90	1.74	2.43	4.23	3.03	1.41	3.68	
C3-Naphthalenes	µg/kg	34.6	391	<1	<1	<1	230	<1	196	<1	4.91	2.76	4.86	3.30	24.67	5.67	1.40	<1	13.27	4.00	<1	187	2.84	2.01	<1	214	
Chrysene	µg/kg	108	846	<1	<1	<1	3.42	2.47	<1	5.47	2.81	5.95	3.30														

MUPP Xlinks Sediment Sample Chemistry Results

Organics & Nutrients	Unit	UK_01	UK_02	UK_03	UK_04	UK_05	UK_06	UK_07	UK_09	UK_10	UK_11	UK_13	UK_14	UK_15	UK_16	UK_17	UK_18	UK_19	UK_20	UK_21	UK_23	UK_24	UK_27	UK_30	UK_31
Total Organic Matter	% M/M	2.60	1.80	1.70	1.80	2.50	3.00	2.20	3.70	3.40	4.00	3.90	4.00	3.20	2.30	2.60	3.10	6.20	3.20	3.80	2.60	2.30	2.30	2.40	2.80
Total Organic Carbon	% M/M	0.50	0.43	0.35	0.32	0.51	0.68	0.55	0.83	0.81	0.83	0.69	0.86	0.72	0.54	0.61	0.55	1.19	0.63	0.46	0.44	0.40	0.33	0.43	0.45
Moisture Content	% M/M	30.30	22.40	33.50	30.30	33.50	31.10	31.60	37.80	34.00	41.50	37.80	35.80	35.20	16.00	29.60	35.50	49.00	27.90	21.30	20.00	20.40	14.80	25.20	30.60
Extractable Organic Halogens	mg/kg	30.90	34.00	<0.20	<0.20	<0.20	42.10	65.60	20.60	68.00	87.80	107.00	<0.20	118.00	<0.20	<0.20	<0.20	<0.20	21.80	29.60	<0.20	<0.20	<0.20	<0.20	<0.20
Organics & Nutrients	Unit	UK_33	UK_34	UK_35	UK_36	UK_37	UK_38	UK_39	UK_40	UK_41	UK_42	UK_43	UK_44	UK_45	UK_46	UK_51	UK_52	UK_53	UK_54	UK_55	UK_56	UK_57	UK_58	UK_59	UK_61
Total Organic Matter	% M/M	2.40	2.10	2.50	2.70	2.00	2.50	1.80	2.10	1.90	1.60	1.70	1.80	1.90	2.30	1.80	2.40	2.40	2.60	2.70	4.20	3.90	2.40	2.40	2.40
Total Organic Carbon	% M/M	0.40	0.26	0.41	0.53	0.33	0.49	0.38	0.42	0.34	0.38	0.29	0.30	0.27	0.27	0.44	0.32	0.40	0.42	0.41	0.45	0.96	0.85	0.35	0.37
Moisture Content	% M/M	13.60	14.80	27.70	32.60	19.20	26.30	24.20	31.60	28.90	30.20	30.30	20.60	24.50	13.90	27.80	22.40	25.50	27.00	29.30	29.30	33.10	31.50	28.90	28.00
Extractable Organic Halogens	mg/kg	<0.20	<0.20	31.00	<0.20	21.40	<0.20	25.30	21.40	22.20	24.10	26.20	26.20	24.40	115.00	42.40	94.40	96.40	27.00	<0.20	107.00	30.90	<0.20	33.80	67.90

## 1.2 References

CCME (1999). Canadian sediment quality guidelines for the protection of aquatic life: Summary tables. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers for the Environment, Winnipeg.

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