



Water Quality Test Report

Dredging, Land Reclamation and Revetment Works at Gulhifalhu

Phase 2



Number: 041 Report Date: 19/12/2023 Week: 50-2023 Period: 11/12/2023 to 17/12/2023

Project : Dredging, Land Reclamation and Revetment Works at Gulhifalhu
Contract number : (AGR)471-PRIV/2021/123
Project number [MIAS] : 46-046

Document number : 46-046-WQTR-041
Contractor : Boskalis Westminster Contracting Ltd
Client : Ministry of Construction and Infrastructure
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Environmental Water Sampling Activities

Weekly water samples were taken and analysed for TSS at the following locations:
Reclamation area at 8 locations taken on 11-DEC-23 & 16-DEC-23 and analysed on 12,13 & 17-DEC-23.
Primary extended borrow area at 13 locations on 11-DEC-23 and analysed on 12 & 13-DEC-23.
Alternative A borrow area at 8 locations on 16-DEC-23 and analysed on 17-DEC-23.
Alternative B borrow area at 12 locations on 11-DEC-23 and analysed on 12 & 13-DEC-23.

Environmental TSS Analysis Method

Samples are obtained using a Niskin bottle and stored in bottles of transparent material. Samples are stored in a dark fridge before the determination of suspended solids. Interpret results obtained for samples that have been stored more than 2 days with caution.
Lab Methodology used is the official authorized approved British Standard BS EN 872:2005 BS 6068-2.54:2005 for the Water Quality - Determination of Suspended Solids - Method by filtration through glass fibre filters. The European Standard EN 872:2005 has the status of a British Standard. The lower limit of the determination is about 2 mg/l. No upper limit has been established.
Concentration of Suspended Solids is determined by using a vacuum filtration apparatus and glass fibre filters through which the sample is filtered. The filter is then dried at 105 °C and the mass of the residue retained on the filter is determined by weighing on a calibrated analytical balance scale.
Blank tests are performed during each analysis to check the loss of mass during filtration by running a similar procedure but using 150 ml of distilled water instead of the sample. Quality checks are performed with a reference suspension, microcrystalline cellulose, of 500 mg/L - recovery shall be between 90 % and 110%.

Equipment Summary

Niskin water sampler with a 400 g drop messenger for obtaining water samples at the surface (~1.5 m).
Transparent bottles and Cool box to transport and store samples, preferably between 1 °C and 5 °C.
Analytical balance, capable of weighing to an accuracy of at least 0,1 mg.
Borosilicate glass fibre filters.
Equipment for vacuum or pressure filtration, to accommodate the selected filters.
Graduated cylinder to accurately measure quantities in ml.
Erlenmeyer flask to collect the water from water sample.
Drying support of suitably surfaced material, to support the filters in the drying oven (5.3), e.g. Petridishes.
Drying oven, capable of maintaining a temperature of 105 °C ± 2 °C.

Limit Applicability

Maintain a threshold level for turbidity at all reefs within the atoll lagoon in proximity to the dredging site, measured as Total Suspended Solids (TSS) to a maximum of 10 mg/L not exceeding 20% of the measurements. Exceptions shall be made where background rates exceed the threshold level and in reefs where extensive reclamation work has been undertaken (including e.g. Thilafushi, Gulhifalhu, Villigili, Malé, Hulhumalé). Considerations shall also be made to account for naturally elevated levels of turbidity which may occur during storm events or bad weather.

Calibration

Analytical balance was calibrated on 12-DEC-23, 13-DEC-23 & 17-DEC-23

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Water Sample Locations - Reclamation Area



Location ID	Area	Type	TSS limit applicable
W2	Reclamation	Within Project direct footprint	No
W5	Reclamation	Reef where extensive reclamation work has been undertake	No
W7	Reclamation	Reef where extensive reclamation work has been undertake	No
W10	Reclamation	Reef where extensive reclamation work has been undertake	No
W11	Reclamation	Reef where extensive reclamation work has been undertake	No
W14	Reclamation	Reef where extensive reclamation work has been undertake	No
W15	Villigili	Within Project direct footprint	No
W16	Reclamation	Reef where extensive reclamation work has been undertake	No

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Water Sample Locations - Extended Primary Borrow Area



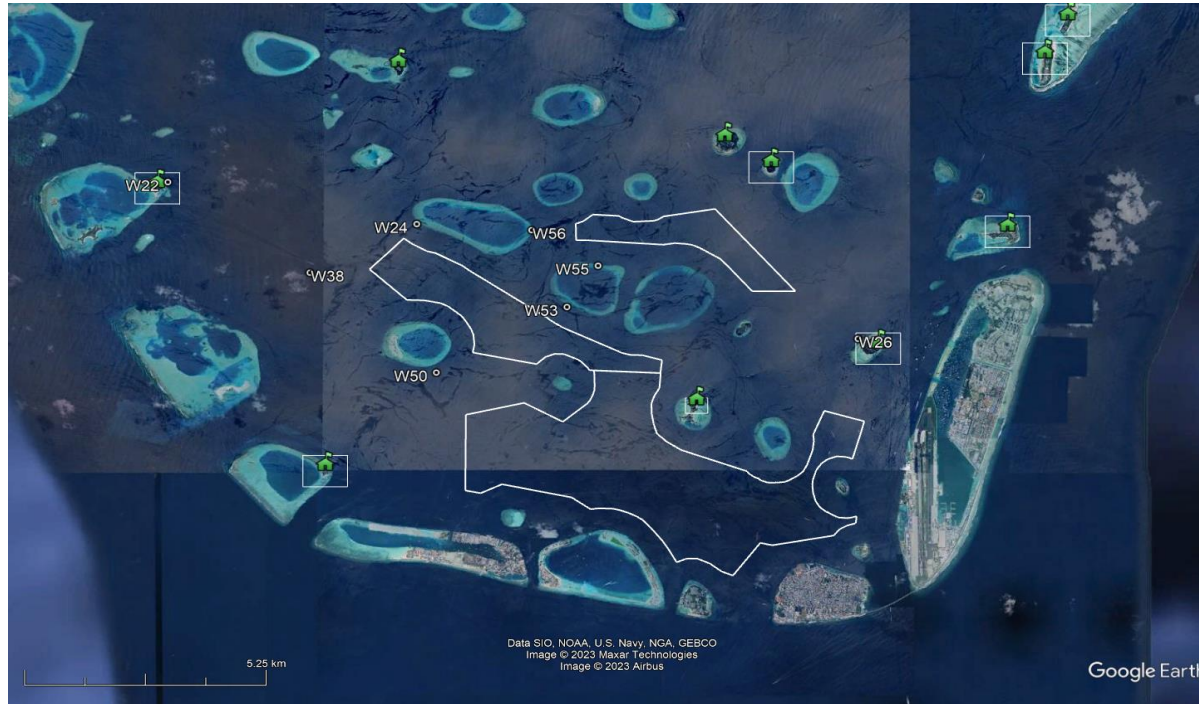
Location ID	Area	Type	TSS limit applicable
W18	Primary Borrow	Sensitive Receiver	Yes
W19	Primary Borrow	Sensitive Receiver	Yes
W20	Primary Borrow	Previous Construction Site	No
W25	Primary Borrow	Sensitive Receiver	Yes
W27	Primary Borrow	Sensitive Receiver	Yes
W36	Primary Borrow	Previous Construction Site	No
W38	Primary Borrow	Sensitive Receiver	Yes
W40	Primary Borrow	Within Borrow Area	No
W45	Primary Borrow	Within Borrow Area	No
W46	Primary Borrow	Sensitive Receiver	Yes
W47	Primary Borrow	Sensitive Receiver	Yes
W50	Primary Borrow	Sensitive Receiver	Yes
W51	Primary Borrow	Sensitive Receiver	Yes

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Water Sample Locations - Alternative A Borrow Area



Location ID	Area	Type	TSS limit applicable
W22	Alternative A Borrow Area	Sensitive Receiver	Yes
W24	Alternative A Borrow Area	Sensitive Receiver	Yes
W26	Alternative A Borrow Area	Sensitive Receiver	Yes
W38	Alternative A Borrow Area	Sensitive Receiver	Yes
W50	Alternative A Borrow Area	Sensitive Receiver	Yes
W53	Alternative A Borrow Area	Sensitive Receiver	Yes
W55	Alternative A Borrow Area	Sensitive Receiver	Yes
W56	Alternative A Borrow Area	Sensitive Receiver	Yes

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Water Sample Locations - Alternative B Borrow Area



Location ID	Area	Type	TSS limit applicable
W24	Alternative B Borrow Area	Sensitive Receiver	Yes
W26	Alternative B Borrow Area	Sensitive Receiver	Yes
W28	Alternative B Borrow Area	Sensitive Receiver	Yes
W30	Alternative B Borrow Area	Sensitive Receiver	Yes
W32	Alternative B Borrow Area	Sensitive Receiver	Yes
W54	Alternative B Borrow Area	Sensitive Receiver	Yes
W55	Alternative B Borrow Area	Sensitive Receiver	Yes
W56	Alternative B Borrow Area	Sensitive Receiver	Yes
W57	Alternative B Borrow Area	Sensitive Receiver	Yes
W58	Alternative B Borrow Area	Sensitive Receiver	Yes
W59	Alternative B Borrow Area	Sensitive Receiver	Yes
W60	Alternative B Borrow Area	Sensitive Receiver	Yes



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Daily Water Quality Results - Reclamation Area

Sample No	Location	Sample Type	Depth	Sample date	Analysis date	Physical appearance	Test Method	Total Suspended Solids (TSS)	Unit
1	W2	Sea water	Surface	11 December 2023	12 December 2023	Clear with particles	BS EN 872:2005	3.3	mg/L
2	W5	Sea water	Surface	11 December 2023	12 December 2023	Clear with particles	BS EN 872:2005	1.7	mg/L
3	W7	Sea water	Surface	11 December 2023	12 December 2023	Clear with particles	BS EN 872:2005	6.5	mg/L
4	W10	Sea water	Surface	11 December 2023	12 December 2023	Clear with particles	BS EN 872:2005	1.3	mg/L
5	W11	Sea water	Surface	11 December 2023	12 December 2023	Clear with particles	BS EN 872:2005	2	mg/L
6	W14	Sea water	Surface	11 December 2023	12 December 2023	Clear with particles	BS EN 872:2005	4.2	mg/L
7	W15	Sea water	Surface	11 December 2023	12 December 2023	Clear with particles	BS EN 872:2005	15.5	mg/L
8	W16	Sea water	Surface	11 December 2023	12 December 2023	Clear with particles	BS EN 872:2005	3.3	mg/L
9	W15	Sea water	Surface	16 December 2023	17 December 2023	Clear with particles	BS EN 872:2006	1.2	mg/L

Observations & Activities

One exceedance was observed at W15 on 11-DEC-23. Simultaneously, measurements were low (see 46-046-EWMMR-041). An additional sample was taken at W15 on 16-DEC-23.



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Daily Water Quality Results - Extended Primary Borrow Area

Table with 10 columns: Sample No, Location, Sample Type, Depth, Sample date, Analysis date, Physical appearance, Test Method, Total Suspended Solids (TSS), Unit. Rows 10-22 show sea water samples from locations W18 to W51.

Observations & Activities

Empty rectangular box for observations and activities.

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Daily Water Quality Results - Alternative A Borrow Area

Results	Sample No	Location	Sample Type	Depth	Sample date	Analysis date	Physical appearance	Test Method	Total Suspended Solids (TSS)	Unit
	23	W22	Sea water	Surface	16 December 2023	17 December 2023	Clear with particles	BS EN 872:2005	0.9	mg/L
	24	W24	Sea water	Surface	16 December 2023	17 December 2023	Clear with particles	BS EN 872:2005	3	mg/L
	25	W26	Sea water	Surface	16 December 2023	17 December 2023	Clear with particles	BS EN 872:2005	1.3	mg/L
	26	W38	Sea water	Surface	16 December 2023	17 December 2023	Clear with particles	BS EN 872:2005	1.5	mg/L
	27	W50	Sea water	Surface	16 December 2023	17 December 2023	Clear with particles	BS EN 872:2005	0.9	mg/L
	28	W53	Sea water	Surface	16 December 2023	17 December 2023	Clear with particles	BS EN 872:2005	1.5	mg/L
	29	W55	Sea water	Surface	16 December 2023	17 December 2023	Clear with particles	BS EN 872:2005	2.9	mg/L
	30	W56	Sea water	Surface	16 December 2023	17 December 2023	Clear with particles	BS EN 872:2005	1.3	mg/L

Observations & Activities

Elevated turbidity was measured around W56, W55 and W53 (Alternative A) due to the Dhiyaneru project reclamation works.



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Daily Water Quality Results - Alternative B Borrow Area

Table with 10 columns: Sample No, Location, Sample Type, Depth, Sample date, Analysis date, Physical appearance, Test Method, Total Suspended Solids (TSS), Unit. Rows 31-42 show sea water samples with TSS values ranging from 1.8 to 5.9 mg/L.

Observations & Activities

Empty rectangular box for observations and activities.

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