



Load out Facility Water Quality Monitoring

Dredging Operation
Fourth Round

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Dredging Operation
Fourth Round

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1 Introduction

1.1 Background

Airbus A380 wings are dispatched individually from Airbus' Broughton factory by road to the nearby River Dee, where the wings are taken to a load out facility and placed onto the Afon Dyfrdwy, a bespoke vessel with shallow draft and jet thrusters, and transported to the Port of Mostyn on the Welsh coast of the Dee Estuary. In order to maintain the load out facility clear of sediment, a bespoke dredger, the Arenig Fawr, has been in operation since 2007. During 2012, the dredger operated on average approximately 4.61 hours per day for approximately 296 days of the year.

Annual monitoring of the dredging operation at the load out facility (LoF) is being undertaken to determine the effect this operation is having on the water quality of the River Dee.

1.2 Report structure

This report presents the findings of the fourth round of water quality monitoring. The methods used to collect the data are described in **Section 2**, with the monitoring results presented in **Section 3**. Conclusions and recommendations are presented in **Sections 4** and **5**, respectively.

2 Methodology

2.1 Introduction

Royal HaskoningDHV commissioned ESG Pelorus Surveys to collect and analyse a series of water samples over a neap tide on the River Dee when dredging was taking place on 16th August 2013. The survey was carried out during neap tides and low river flows, as agreed through consultation with Natural Resources Wales (NRW), to present the 'worst case' scenario.

The survey methodology described below was agreed with NRW prior to the commencement of the monitoring programme and comprises a reduced level of monitoring compared to previous years. This reduction was considered appropriate as the previous years monitoring has consistently shown the dredging to be having a small, localised, effect on river water quality.

As such, and going forward, the monitoring is to be undertaken on one neap tide, rather than two, and along three chainages (75m upflow, 200m and 500m downflow), rather than six (which also included at the LoF, 50m and 100m).

2.2 Water quality survey

2.2.1 Survey methodology

A YSI 6600 sonde was deployed from a vessel via an umbilical cable and safety rope. A series of turbidity and dissolved oxygen measurements were taken at three points across the river (near the north bank, at the centre, and near the south bank), where possible, and at three chainages along the river, referenced from the load out facility (75m up flow¹ of the dredging (representing conditions that are not influenced by the dredging) and at 200m and 500m down flow of the dredging (see **Figure 2-1**)). The location of the survey stations was provided by Real Time Kinematic (RTK) GPS with the measurements taken at the same relevant locations as the previous (2012) survey.

At each location three measurements were taken at 0.5 metres below water surface, 0.5 metres above river bed and mid water column, where possible. Data were recorded directly to a handset and transferred to a land based server. Due to restricted water depth, a total of 12 in-situ measurements were taken during the survey, out of a target of 27.

In order to convert turbidity (NTU) to Total Suspended Solids (TSS) (mg/l), nine water samples were collected and analysed using gravimetric analysis.

2.2.2 Analysis

As a result of the shallow water conditions at the time of the survey, samples at different water depths were only taken at three stations. Consequently, and in order to be able to determine any trends in the data, where more than one sample was collected at a station, the TSS and DO recordings have been averaged.

3 Results

3.1 Introduction

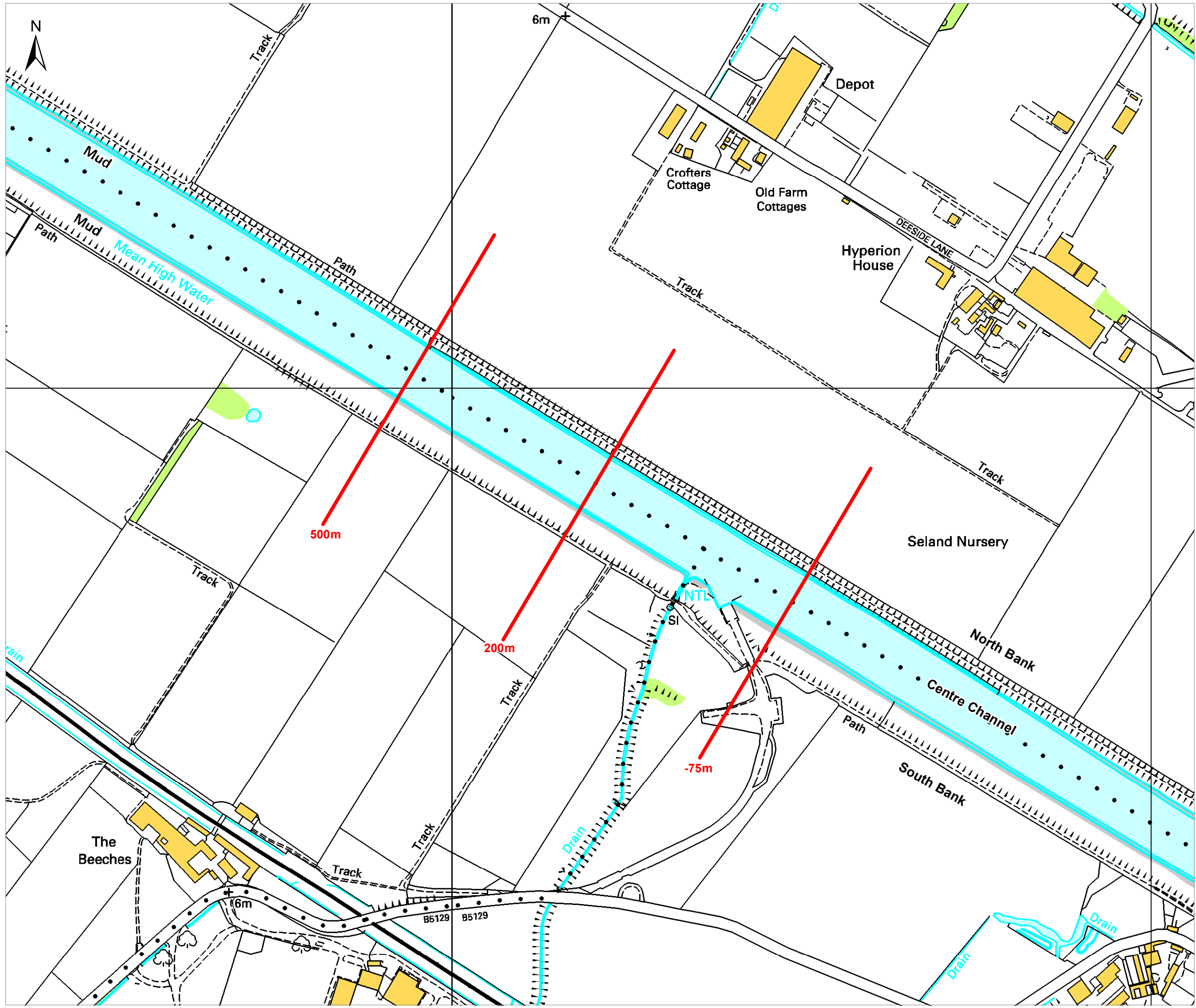
The raw data collected during the water quality survey can be found in **Appendix A** and are presented graphically in **Appendix B**. The conversion chart created using recorded turbidity (NTU) against TSS (mg/l) is presented in **Figure A-1** in **Appendix A**. The chart depicts a line of best fit along with its equation.

3.2 Water quality analysis

3.2.1 Total Suspended Solids

The results of the TSS measurements taken on 16th August 2013 are presented in **Table B-1** and **Figure B-1**, in **Appendix B**. The figure shows that, in all cases, TSS levels were lower at 200m downflow of the dredging, with levels returning to levels similar to those recorded upflow of the dredging at 500m downflow.

¹ The terms up flow and down flow have been used in this report, rather than upstream and downstream, as the environment in which the dredging takes place is tidal. Consequently, unlike normal riverine conditions, the direction of flow varies depending on the state of the tide.



Key

Water Sample Locations

Reproduced from Ordnance Survey digital map data
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Title
Location of Water Quality Measurements

Project
Load Out Facility Water Quality Monitoring

Client
Airbus Operations Ltd

Date	Scale
18/10/2013	1:5000

Figure
2.1

Checked by	Revision
JG	2



The highest TSS level recorded was 124.6 mg/l, recorded at 500m from the dredging near to the north bank of the river, whilst the lowest recorded level was 81.9 mg/l at 200m from the dredging in the centre of the channel. The largest difference between the upflow and downflow recordings of TSS was along the south bank, with a TSS level of 104.2 mg/l upflow and 115.6 mg/l 500m downflow; however, this higher level is still below the level recorded upflow of the dredging along the north bank.

3.2.2 Dissolved Oxygen

The results of the DO measurements taken on 16th August 2013 are presented in **Table B-1** and **Figure B-2**, in **Appendix B**. Dissolved oxygen concentrations showed low variation between sample locations, ranging from approximately 104.5% to 107.0%.

The results show a similar trend to the TSS levels, dropping slightly downflow of the dredging at 200m and then rising again at 500m. The exception to this was in the centre channel where DO levels were lowest at 500m downflow of the dredging.

4 Conclusions

4.1 Total Suspended Solids

Due to the shallow water levels and the need to average some of the TSS values, no inference can be made as to the effects the dredging is having at different depths of the water column. However, as for previous years monitoring, the data does show that the dredging is no longer affecting water quality at 200m downflow, given that all TSS levels were below those recorded upflow.

As a result, it is considered that the effects of the dredging operations remain localised to within 200m of the LoF.

4.2 Dissolved Oxygen

Changes in DO levels followed a similar trend as TSS levels in the river; however, with a much reduced level of variation, the largest being only 1.9%. Overall, the dredging operations are not considered to be significantly affecting the dissolved oxygen field in the river.

5 Recommendations

Following on from this report it is recommended that:

- The findings of this monitoring report should be discussed with NRW to ensure that they are satisfactory in providing evidence that the dredging operations are not causing pollution.
- Based upon the findings of the four monitoring rounds, the need to continue monitoring should be discussed with NRW.

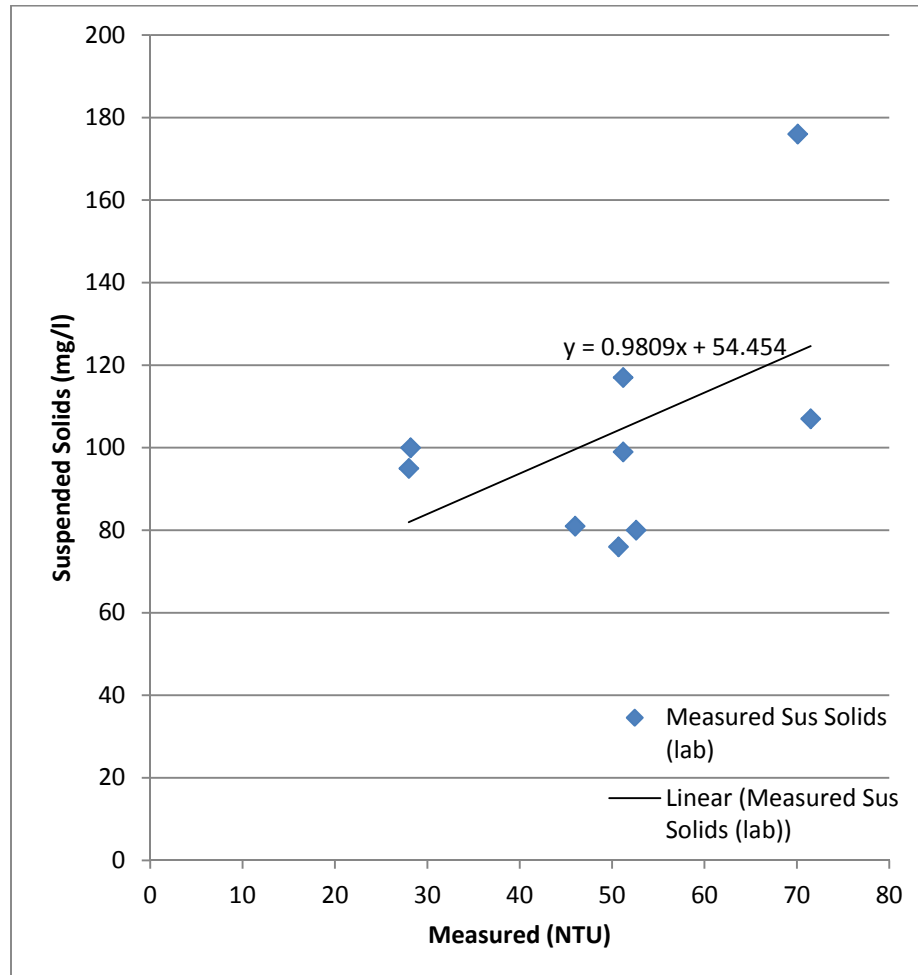
Appendix A

Water Quality Data

Table A-1 Water quality results collected in the River Dee from around the load out facility on 16th August 2013.

Station	DateTime	Temp	SpCond	Salinity	Depth	pH	Turbidity	DO	Suspended Solids - Lab Tests	Calculated Suspended Solids
	M/D/Y	C	mS/cm	ppt	m		NTU	%	mg/l	mg/l
-75N	08/16/13 07:51:05	18.93	8.021	4.47	1.144	8.25	70.1	107	176	123.2
-75C	08/16/13 07:51:44	18.95	8.376	4.68	1.134	8.21	51.2	107.2	99	104.7
-75C	08/16/13 07:54:32	18.94	8.521	4.77	0.731	8.15	42	106.8		95.7
-75S	08/16/13 08:02:39	18.92	8.843	4.96	1.084	8.18	50.7	106.4	76	104.2
200N	08/16/13 08:13:34	18.92	10.45	5.94	0.55	8.18	28.2	106.8	100	82.1
200C	08/16/13 08:37:23	18.91	6.849	3.77	0.329	8.14	28	104.3	95	81.9
200S	08/16/13 08:45:28	18.93	6.603	3.63	0.286	8.17	46	104.5	81	99.6
500N	08/16/13 08:58:16	18.95	5.548	3.01	0.865	8.2	71.5	106.8	107	124.6
500C	08/16/13 09:04:32	18.92	4.849	2.61	0.994	8.18	52.6	105.4	80	106.0
500C	08/16/13 09:05:47	18.94	4.708	2.53	0.44	8.21	48.1	105.8		101.6
500S	08/16/13 09:15:30	18.92	4.732	2.54	0.825	8.11	51.2	105.2	117	104.7
500S	08/16/13 09:17:03	18.95	4.582	2.46	0.721	8.18	73.4	105.4		126.5

Figure A-1 NTU – Suspended Solids Conversion



Our Ref: EXR/162289 (Ver. 1)

Your Ref: L3216-13

September 5, 2013



Environmental Chemistry

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Mr G Keefe
ESG Deeside
Unit 18
Geotechnical House
Deeside Industrial Estate
Deeside
Clwyd
CH5 2LR

For the attention of Mr G Keefe

Dear Mr Keefe

Water Sample Analysis - River Dee Water Quality

Samples from the above site have been analysed in accordance with the schedule supplied.

The sample details and the results of analyses for these samples are given in the appended report.

An invoice for this work will follow under a separate cover.

Please be aware that our policy for the retention of paper based laboratory records and analysis reports is 6 years.

The work was carried out in accordance with Environmental Scientifics Group Ltd (Laboratory and Analytical) Standard Terms and Conditions of Contract.

If I can be of any further assistance please do not hesitate to contact me.

Yours sincerely

for ESG

A handwritten signature in black ink, appearing to read 'J Colbourne'.

J Colbourne
Project Co-ordinator
01283 554547

TEST REPORT

WATER SAMPLE ANALYSIS



Report No. EXR/162289 (Ver. 1)

ESG Deeside
Unit 18
Geotechnical House
Deeside Industrial Estate
Deeside
Clwyd
CH5 2LR

Site: River Dee Water Quality

The 9 samples described in this report were registered for analysis by ESG on 23-Aug-2013. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 05-Sep-2013

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS accredited
Any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by ESG.

The following tables are contained in this report:

Table 1 Main Analysis Results (Page 2)
Analytical and Deviating Sample Overview (Page 3)
Table of Method Descriptions (Page 4)
Table of Report Notes (Page 5)

On behalf of
ESG :
Declan Burns

A handwritten signature in black ink, appearing to read 'Declan Burns'.

Operations Director
Laboratory and Analytical Business

Date of Issue: 05-Sep-2013

Tests marked '^' have been subcontracted to another laboratory.

ESG accepts no responsibility for any sampling not carried out by our personnel.

Where individual results are flagged see report notes for status.

Customer ESG Deeside
 Site River Dee Water Quality
 Report No W162289

Consignment No W58197

Date Logged 23-Aug-2013

Report Due 05-Sep-2013

ID Number	Description	MethodID	CUSTSERV	WSLM10	WSLM20	WSLM27
		Sampled	Report B	Suspended Solids	Dissolved Oxygen	Total Dissolved Solids
Accredited to ISO17025				✓		
EX/1417257	0644 -75W	16/08/13				
EX/1417258	0740 -75C	16/08/13				
EX/1417259	0750 -75\$	16/08/13				
EX/1417260	0801 200N	16/08/13				
EX/1417261	0821 200C	16/08/13				
EX/1417262	0831 200\$	16/08/13				
EX/1417263	0851 500N	16/08/13				
EX/1417264	0859 500C	16/08/13				
EX/1417265	0920 500\$	16/08/13				

Note: For analysis where the scheduled turnaround is greater than the holding time we will do our utmost to prioritise these samples. However, it is possible that samples could become deviant whilst being processed in the laboratory.

In this instance please contact the laboratory immediately should you wish to discuss how you would like us to proceed. If you do not respond within 24 hours, we will proceed as originally requested.

Deviating Sample Key

- A The sample was received in an inappropriate container for this analysis
- B The sample was received without the correct preservation for this analysis
- C Headspace present in the sample container
- D The sampling date was not supplied so holding time may be compromised - applicable to all analysis
- E Sample processing did not commence within the appropriate holding time

Requested Analysis Key

- Analysis Required
- Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
- No analysis scheduled
- Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Water	WSLM10	As Received	Determination of Suspended Solids in waters by gravimetry
Water	WSLM20.	As Received	Determination of Dissolved Oxygen in waters using an oxygen detecting probe
Water	WSLM27	As Received	Gravimetric Determination

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,

- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
All results on MCERTS reports are reported on a 105°C dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis

Unless stated otherwise results are expressed as mg/l

Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,

- Results are expressed as mg/kg
- SG is expressed as g/cm³@ 15°C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile

CR Denotes Crocidolite

AM Denotes Amosite

NAIIS No Asbestos Identified in Sample

NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.

\$\$ Unable to analyse due to the nature of the sample

¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.

This may have resulted in deterioration of the sample(s) during transit to the laboratory.

Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling

¥ Results for guidance only due to possible interference

& Blank corrected result

I.S Insufficient sample to complete requested analysis

I.S(g) Insufficient sample to re-analyse, results for guidance only

Intf Unable to analyse due to interferences

N.D Not determined

N.Det Not detected

NS Information Not Supplied

Req Analysis requested, see attached sheets for results

▮ Raised detection limit due to nature of the sample

* All accreditation has been removed by the laboratory for this result

‡ MCERTS accreditation has been removed for this result

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

END OF REPORT

Where individual results are flagged see report notes for status.

Appendix B

Graphs

The data used to produce the **Figures B-1** and **B-2** are presented in **Table B-1**.

Table B-1 **Total Suspended Solid (TSS) and Dissolved Oxygen (%) data collected around the load out facility on 16 August 2013 (N = north bank; C = centre channel; S = south bank; * = averaged data).**

Distance (m)	TSS (mg/l)	DO (%)
-75 N	123.2	107.0
200 N	82.1	106.8
500 N	124.6	106.8
-75 C*	100.2	107.0
200 C	81.9	106.8
500 C*	103.8	105.6
-75 S	104.2	106.4
200 S	99.6	104.5
500 S*	115.6	105.3

Figure B-1 Total Suspended Solid (TSS) levels in the River Dee collected around the load out facility on 16th August 2013

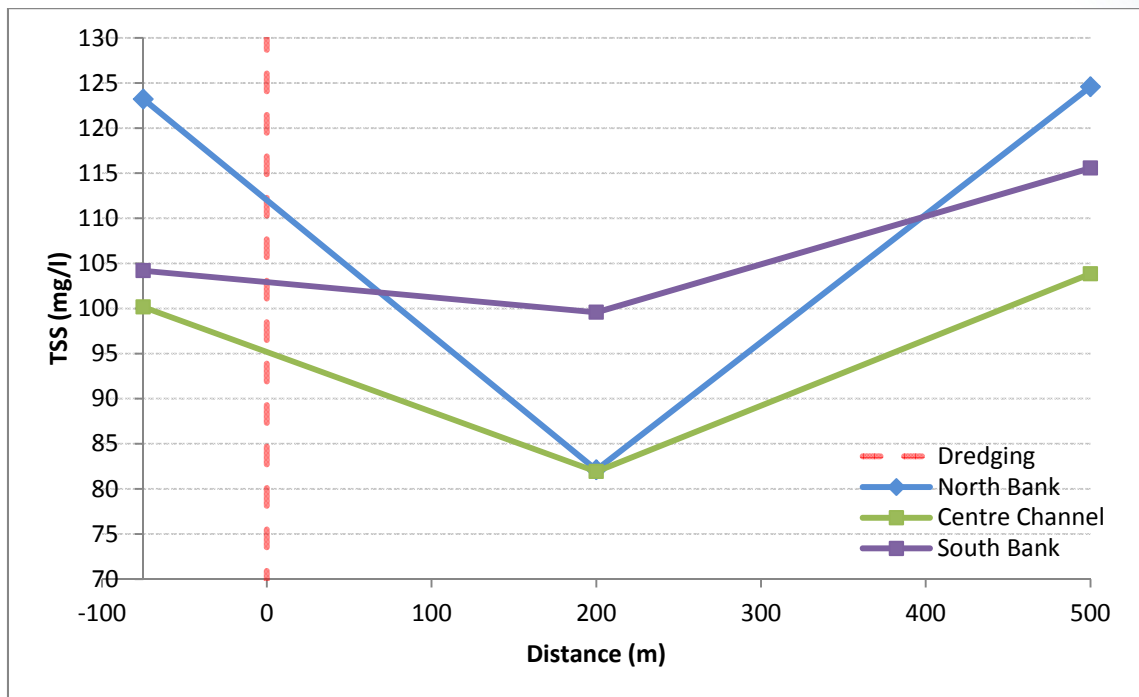


Figure B-2 Dissolved oxygen (DO) levels in the River Dee collected around the load out facility on 16th August 2013

