Annual Environmental Report

2021

Malahide

D0021-01

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1 EXECUTIVE SUMMARY AND INTRODUCTION TO THE 2021 AER

This Annual Environmental Report has been prepared for D0021-01, Malahide, in Dublin in accordance with the requirements of the wastewater discharge licence for the agglomeration. Specified reports where relevant are included as an appendix to the AER.

1.1 ANNUAL STATEMENT OF MEASURES

A summary of any improvements undertaken is provided where applicable.

There were no capital works, significant changes or operational improvements undertaken in 2021.

The upgrade works planned for 2022 at the Malahide WWTP include the following:

- Improvements to the aeration system (new diffuser system and blowers),
- Replacement of the centrifuges with screw press dewatering units, and
- Upgrade to various electrical components (new VSDs, wiring upgrades, control enhancements).

These works are expected to take approximately 22 weeks to complete.

1.2 TREATMENT SUMMARY

The agglomeration is served by a wastewater treatment plant(s)

- MALAHIDE WWTP with a Plant Capacity PE of 27000, the treatment type is 2 - Secondary treatment

1.3 ELV OVERVIEW

The overall compliance of the final effluent with the Emission Limit Values (ELVs) is shown below. More detailed information on the below ELV’s can be found in Section 2.

Discharge Point Reference	Treatment Plant	Discharge Type	Compliance Status	Parameters failing if relevant
TPEFF0900D0021SW001	MALAHIDE WWTP	Treated	Compliant	N/A

1.4 LICENCE SPECIFIC REPORTING

Assessment / Report
There are no Licence Specific Reports included in this AER.

2 TREATMENT PLANT PERFORMANCE AND IMPACT SUMMARY

2.1 MALAHIDE WWTP - TREATED DISCHARGE

2.1.1 INFLUENT MONITORING SUMMARY - MALAHIDE WWTP

A summary of influent monitoring for the treatment plant is presented below. This monitoring is primarily undertaken in order to determine the overall efficiency of the plant in removing pollutants from the raw wastewater.

Parameters	Number of Samples	Annual Max	Annual Mean
Suspended Solids mg/l	17	683	306.45
COD-Cr mg/l	17	1812	647.89
BOD, 5 days with Inhibition (Carbonaceous BOD) mg/l	15	787	290.1
Total Nitrogen mg/l	17	119	74.83
Total Phosphorus (as P) mg/l	17	12.4	8.49
Hydraulic Capacity	N/A	11611	4958

If other inputs in the form of sludge / leachate are added to the WWTP then these are included in Section 2.1.5 if applicable.

Significance of Results:

The annual mean hydraulic loading is less than the peak Treatment Plant Capacity. The annual maximum hydraulic loading is less than the peak Treatment Plant Capacity. Further details on the plant capacity and efficiency can be found under the sectional ‘Operational Performance Summary’. The design of the wastewater treatment plant allows for peak values and therefore the peak loads have not impacted on compliance with Emission Limit Values.

2.1.2 EFFLUENT MONITORING SUMMARY - TPEFF0900D0021SW001

Parameter	WWDL ELV (Schedule A)	ELV with Condition 2 Interpretation included Note 1	Interim % reduction from influent concentration	Number of sample results	Number of exceedances	Number of exceedances with Condition 2 Interpretation included	Annual Mean	Overall Compliance (Pass/Fail)
COD-Cr mg/l	125	250	N/A	19	0	0	34.68	Pass
Suspended Solids mg/l	35	87.5	N/A	19	0	0	9.8	Pass
Total Oxidised Nitrogen (as N) mg/l	35	42	N/A	19	0	0	8.72	Pass
BOD, 5 days with Inhibition (Carbonaceous BOD) mg/l	25	50	N/A	17	0	0	3.65	Pass
pH pH units	6.00	9.00	N/A	19	0	0	7.66	Pass
Ammonia-Total (as N) mg/l	5.00	6.00	N/A	19	0	0	1.19	Pass
Conductivity @20°C µS/cm	N/A	N/A	N/A	19	N/A	N/A	1130	
Nitrite (as N) mg/l	N/A	N/A	N/A	19	N/A	N/A	0.31	
ortho-Phosphate (as P) - unspecified mg/l	N/A	N/A	N/A	19	N/A	N/A	2.67	

Parameter	WWDL ELV (Schedule A)	ELV with Condition 2 Interpretation included [Note 1]	Interim % reduction from influent concentration	Number of sample results	Number of exceedances	Number of exceedances with Condition 2 Interpretation included	Annual Mean	Overall Compliance (Pass/Fail)
Total Nitrogen mg/l	N/A	N/A	N/A	19	N/A	N/A	11.78	
Total Phosphorus (as P) mg/l	N/A	N/A	N/A	19	N/A	N/A	3.14	
Coliform Bacteria (Total) no./100mls	N/A	N/A	N/A	5	N/A	N/A	N/A	
E. Coli no./100mls	N/A	N/A	N/A	5	N/A	N/A	N/A	
Enterococci (Intestinal) no./100mls	N/A	N/A	N/A	2	N/A	N/A	N/A	
Nitrate (as N) mg/l	N/A	N/A	N/A	19	N/A	N/A	8.43	
Dissolved Inorganic Nitrogen (as N) mg/l	N/A	N/A	N/A	19	N/A	N/A	9.91	

Notes:
1 – This represents the Emission Limit Values after the Interpretation provided for under Condition 2 of the licence is applied
2 – For pH the WWDA specifies a range of pH 6 - 9

Cause of Exceedance(s):

Not applicable

Significance of Results:

The WWTP is compliant with the ELV's set in the Wastewater Discharge Licence.

2.1.3 AMBIENT MONITORING SUMMARY FOR THE TREATMENT PLANT DISCHARGE TPEFF0900D0021SW001

A summary of monitoring from ambient monitoring points associated with the wastewater discharge is provided in the sections below. For discharges to rivers upstream (U/S) and downstream (D/S) location data is provided. For other ambient points in lakes, coastal or transitional waters, monitoring data from the most appropriate monitoring station is selected.

The table below provides details of ambient monitoring locations and details of any designations as sensitive areas.

Ambient Monitoring Point from WWDL (or as agreed with EPA)	Irish Grid Reference	River Station Code	Bathing Water	Drinking Water	FWPM	Shellfish	WFD Ecological Status
Downstream (BM210)	322582, 246924	CW09001007BM2001	No	No	No	Yes	Moderate
Downstream (BM220)	322731, 246527	CW09001007BM2002	No	No	No	Yes	Moderate
Downstream (BM230)	323481, 246290	CW09001007BM2003	No	No	No	Yes	Moderate

The results for ambient results and / or additional monitoring data sets are included in the **Appendix 7.1 - Ambient monitoring summary.**

Significance of Results:

The WWTP discharge was compliant with the ELV's set in the wastewater discharge licence.

The ambient monitoring results do not meet the required EQS downstream of the discharge. The EQS relates to the Oxygenation and Nutrient Conditions set out in the Surface Water Regulations 2009.

Based on ambient monitoring results a deterioration in BOD (Station BM220), DIN (Stations BM210, BM 220 & BM230) and Chlorophyll a (median) (Stations BM230) concentrations downstream of the effluent discharge is noted.

A deterioration in water quality has been identified, however it is not known if it or is not caused directly by the WWTP.

The discharge from the wastewater treatment plant does not have an observable negative impact on the Water Framework Directive status.

2.1.4 OPERATIONAL PERFORMANCE SUMMARY - MALAHIDE WWTP

2.1.4.1 Treatment Efficiency Report - MALAHIDE WWTP

Treatment efficiency is based on the removal of key pollutants from the influent wastewater by the treatment plant. In essence the calculation is based on the balance of load coming into the plant versus the load leaving the plant. The efficiency is presented as a percentage removal rate.

A summary presentation of the efficiency of the treatment process including information for all the parameters specified in the licence is included below:

Parameter	Influent mass loading (kg/year)	Effluent mass emission (kg/year)	Efficiency (% reduction of influent load)
TP	14434.9	5328.22	63%
SS	520757.2	17133.21	97%
COD	1100993.9	60860.41	94%
cBOD	496956	6443.86	99%
TN	127166.9	20845.08	84%

Note: The above data is based on sample results for the number of dates reported

2.1.4.2 Treatment Capacity Report Summary - MALAHIDE WWTP

Treatment capacity is an assessment of the hydraulic (flow) and organic (the amount of pollutants) load a treatment plant is designed to treat versus the current loading of that plant.

MALAHIDE WWTP	
Peak Hydraulic Capacity (m^3/day) - As Constructed	15033
DWF to the Treatment Plant (m^3/day)	5011
Current Hydraulic Loading - annual max (m^3/day)	11611
Average Hydraulic loading to the Treatment Plant (m^3/day)	4958
Organic Capacity (PE) - As Constructed	27000
Organic Capacity (PE) - Collected Load (peak week)[Note1]	22076
Organic Capacity (PE) - Remaining	4924
Will the capacity be exceeded in the next three years? (Yes/No)	No

Nominal design capacities can be based on conservative design principles. In some cases assessment of existing plants has shown organic capacities significantly higher than the nominal design capacity. Accordingly plants that appear to be overloaded when comparing a collected peak load with the nominal design capacity can be fully compliant due to the safety factors in the original design.

2.1.5 SLUDGE / OTHER INPUTS - MALAHIDE WWTP

'Other inputs' to the waste water treatment plant are summarised in table below

Input type	Quantity	Unit	P.E.	% of load to WWTP	Included in Influent Monitoring (Y/N)?	Is there a leachate/sludge acceptance procedure for the WWTP?	Is there a dedicated leachate/sludge acceptance facility for the WWTP? (Y/N)
There is no Sludge and Other Input data for the Treatment Plant included in the AER.							

3 COMPLAINTS AND INCIDENTS

3.1 COMPLAINTS SUMMARY

A summary of complaints of an environmental nature related to the discharge(s) to water from the WWTP and network is included below.

Number of Complaints	Nature of Complaint	Number Open Complaints	Number Closed Complaints
1	Discharge to waters	0	1

3.2 REPORTED INCIDENTS SUMMARY

Environmental incidents that arise in an agglomeration are reported on an on-going basis in accordance with our waste water discharge licences. Where an incident occurs and it is reportable under the licence, it is reported to the Environmental Protection Agency through their Environmental Data Exchange Network, or in some instances by telephone. Some incidents which arise in the agglomeration are recorded by Irish Water but may not be reportable under our licence for example where the incident does not have an impact on environmental performance.

A summary of reported incidents is included below.

3.2.1 SUMMARY OF INCIDENTS

Incident Type	Cause	No. of incident occurrences	Recurring (Y/N)	Closed (Y/N)
Abatement Equipment offline	Plant or equipment breakdown at WWTP	1	No	Yes
Abatement Equipment offline	Plant or equipment breakdown at WWTP	1	No	Yes
Uncontrolled release	Plant or equipment breakdown at WWTP	1	No	Yes

Incident Type	Cause	No. of incident occurrences	Recurring (Y/N)	Closed (Y/N)
Uncontrolled release	Broken Sewer Pipe	1	No	Yes
Uncontrolled release	EO caused by power failure	1	No	Yes
Uncontrolled release	Blocked Sewer	1	No	Yes
Uncontrolled release	SWO exceptional rainfall and overflow expected	1	No	Yes

3.2.2 SUMMARY OF OVERALL INCIDENTS

Question	Answer
Number of Incidents in 2021	7
Number of Incidents reported to the EPA via EDEN in 2021	7
Explanation of any discrepancies between the two numbers above	N/A

4 INFRASTRUCTURAL ASSESSMENTS AND PROGRAMME OF IMPROVEMENTS

4.1 STORM WATER OVERFLOW IDENTIFICATION AND INSPECTION REPORT

A summary of the operation of the storm water overflows and their significance where known is included below:

4.1.1 SWO IDENTIFICATION

WWDL Name / Code for Storm Water Overflow (chamber) where applicable	Irish Grid Ref. (outfall)	Included in Schedule of the WWDL	Significance of the overflow(High / Medium / Low)	Assessed against DoEHLG Criteria	No. of times activated in 2021 (No. of events)	Total volume discharged in 2021 (m^3)	Monitoring Status
TBC	321851, 243988	No	Medium	Meeting	Unknown	Unknown	Not Monitored
TBC	321835, 243989	No	Medium	Not Meeting	Unknown	Unknown	Not Monitored
TBC	322330, 246310	No	Medium	Meeting	Unknown	Unknown	Not Monitored
TBC	322857,244585	No	Medium	Meeting	Unknown	Unknown	Not Monitored
TBC	321007, 245502	No	Medium	Meeting	Unknown	Unknown	Not Monitored
TBC	322899, 244923	No	Medium	Meeting	Unknown	Unknown	Not Monitored

WWDL Name / Code for Storm Water Overflow (chamber) where applicable	Irish Grid Ref. (outfall)	Included in Schedule of the WWDL	Significance of the overflow(High / Medium / Low)	Assessed against DoEHLG Criteria	No. of times activated in 2021 (No. of events)	Total volume discharged in 2021 (m^3)	Monitoring Status
TBC	321661, 246521	No	Medium	Meeting	Unknown	Unknown	Not Monitored
TBC	321000, 245870	No	Medium	Meeting	Unknown	Unknown	Not Monitored
TBC	TBC, TBC	No	Medium	Not yet Assessed	Unknown	Unknown	Not Monitored
S2	322923, 246285	Yes	Medium	Meeting	Unknown	Unknown	Not Monitored
S3	322762, 246363	Yes	Medium	Meeting	Unknown	Unknown	Not Monitored
S8	321692, 243274	Yes	Medium	Meeting	Unknown	Unknown	Not Monitored
SW35	322515, 246319	Yes	Medium	Meeting	20	17354	Monitored

Any TBC SWO(s) were identified as part of the on-going National SWO programme and will be updated in subsequent AER(s) once the information is confirmed.

SWO Summary	
How much sewage was discharged via monitored SWOs in the agglomeration in the year (m^3)?	17354
Is each SWO identified as not meeting DoEHLG Guidance included in the Programme of Improvements?	Yes
The SWO Assessment included the requirements of relevant of WWDL schedules?	Yes

SWO Summary	
Have the EPA been advised of any additional SWOs / changes to Schedule C3 and A4 under Condition 1.7?	No

4.2 REPORT ON PROGRESS MADE AND PROPOSALS BEING DEVELOPED TO MEET THE IMPROVEMENT PROGRAMME REQUIREMENTS

4.2.1 SPECIFIED IMPROVEMENT PROGRAMME SUMMARY

A wastewater discharge licence may require a number of reports on specific subject areas to be prepared for the agglomeration in question. These reports are submitted to the EPA as part of the Annual Environmental Report. This section provides a list of the various reports required for this agglomeration and a brief summary of their recommendations.

Specified Improvement Programmes (under Schedule A and C of WWDL)	Description	Licence Schedule	Licence Completion Date	Date Expired? (N/NA/Y)	Status of Works	Timeframe for Completing the Work	Comments
D0021-SIP:01	Implementation of the measure(s) identified in Condition 5.3(a)(v)	C	14/03/2011	Yes	Works Completed		
D0021-SIP:02	Network improvements under the Malahide Sewerage Scheme	C	31/07/2014	Yes	At Planning Stage		
D0021-SIP:03	S2 - Upgrade of Stormwater Overflows to comply with the criteria outlined in the DoEHLG 'Procedures and Criteria in relation to Storm Water Overflows', 1995	C	31/07/2014	Yes	At Planning Stage		

Specified Improvement Programmes (under Schedule A and C of WWDL)	Description	Licence Schedule	Licence Completion Date	Date Expired? (N/NA/Y)	Status of Works	Timeframe for Completing the Work	Comments
D0021-SIP:04	S3 - Upgrade of Stormwater Overflows to comply with the criteria outlined in the DoEHLG 'Procedures and Criteria in relation to Storm Water Overflows', 1995	C	31/07/2014	Yes	At Planning Stage		
D0021-SIP:05	S35 - Upgrade of Stormwater Overflows to comply with the criteria outlined in the DoEHLG 'Procedures and Criteria in relation to Storm Water Overflows', 1995	C	31/07/2014	Yes	At Planning Stage		
D0021-SIP:06	S8 - Upgrade of Stormwater Overflows to comply with the criteria outlined in the DoEHLG 'Procedures and Criteria in relation to Storm Water Overflows', 1995	C	31/07/2014	Yes	Works Completed		

A summary of the status of any other improvements identified by under Condition 5 assessments- is included below.

4.2.2 IMPROVEMENT PROGRAMME SUMMARY

Improvement Identifier	Improvement Description / or any Operational Improvements	Improvement Source	Expected Completion Date	Comments
No additional improvements planned at this time.				

4.2.3 SEWER INTEGRITY RISK ASSESSMENT

The utilisation of multiple capital maintenance programmes and the outputs of the workshops with the Local Authority Operations Staff held under the programme can be used to satisfy the requirements of Condition 5 regarding network integrity. Improvement works identified by way of these programmes and workshops will be included in the Improvements Summary Tables 4.2.1 and 4.2.2.

5 LICENCE SPECIFIC REPORTS

A wastewater discharge licence may require a number of reports on specific subject areas to be prepared for the agglomeration in question. These reports are submitted to the EPA as part of the Annual Environmental Report. This section provides a list of the various reports required for this agglomeration and a brief summary of their recommendations.

Licence Specific Report	Required by licence	Year included in AER	Included in this AER
Priority Substances Assessment	Yes	2014	No

6 CERTIFICATION AND SIGN OFF

6.1 SUMMARY OF AER CONTENTS

Parameter	Answer
Does the AER include an Executive Summary?	Yes
Does the AER include an assessment of the performance of the Waste Water Works (i.e., have the results of assessments been interpreted against WWDL requirements and or Environmental Quality Standards)?	Yes
Has a Technical amendment/licence review application been submitted to the Agency by IW?	No
List reason e.g., additional SWO identified	N/A
Is there a need to request/advise the EPA of any modification to the existing WWDL with respect to condition 4 changes to monitoring location, frequency etc	No
List reason e.g., changes to monitoring requirements	N/A
Have these processes commenced?	N/A
Are all outstanding reports and assessments from previous AERs included as an appendix to this AER	N/A

I certify that the information given in this Annual Environmental Report is truthful, accurate and complete:

Date: 22/04/2022

This AER has been produced by Irish Water's Environmental Information System (EIMS) and has been electronically signed off in that system for and on behalf of,

Katherine Walshe

Acting Head of Environmental Regulation.

7 APPENDIX

Appendix
Appendix 7.1 - Ambient monitoring summary

Malahide Ambient Monitoring Data 2021

Ambient Monitoring Report Summary Table

Ambient Monitoring Point from WWDL (or as agreed with EPA)	Irish Grid Reference	EPA Feature Coding Tool code	Bathing Water	Drinking Water	FWPM	Shellfish	Current WFD Status 2013-2018
BM210-Causeway Cascade	322582E, 246924N	CW09001007BM2001	No	No	No	No	Moderate
BM220-Malahide Marina	322731E, 246527N	CW09001007BM2002	No	No	No	No	Moderate
BM230-Malahide Navigation Channel	323481E, 246290N	CW09001007BM2003	No	No	No	No	Moderate
Balcarrick Beach, Donabate	324034E, 246133N	N/A	Yes	No	No	No	Good

2021 Ambient Monitoring Summary

Monitoring Result Source	Sample Date	Ammonia	B.O.D.	Chlorophyll a	DIN	Dissolved Oxygen	pH	Salinity	Temp.	Total Nitrogen
		mg/l as N	mg/l	mg/m^3	mg/l	% Sat.	pH	PSU	°C	mg/l as N
BM210	27/05/2020	0.56	2.4	2.82845425	0.75	104.4	8.17	35	12	0.73
BM210	06/09/2020	0.45	3.6	16.43	0.367699	97.9	8	32.51	18.2	0.35355678
	Mean	0.505	3.000	9.629	0.559	101.150	8.085	33.755	15.100	0.542
	95%ile	0.555	3.540	15.750	0.731	104.075	8.162	34.876	17.890	0.711
	Median	0.505	3.000	9.629	0.559	101.150	8.085	33.755	15.100	0.542
BM220	27/05/2020	0.62	4.4	2.82845425	0.79	106.9	8.16	34.9	12	0.79
BM220	06/09/2020	0.41	1.414227125	4.31	0.52	97.4	7.9	34.58	18.1	0.35355678
	Mean	0.515	2.907	4.310	0.655	102.150	8.030	34.740	15.050	0.572
	95%ile	0.610	4.251	4.310	0.777	106.425	8.147	34.884	17.795	0.768
	Median	0.515	2.907	4.310	0.655	102.150	8.030	34.740	15.050	0.572
BM230	27/05/2020	0.55	2.5	34.8	0.7	103.9	8.17	34.8	12	0.7
BM230	06/09/2020	0.4	1.414227125	34.67	0.367699	96.1	7.9	34.67	18.1	0.35355678
	Mean	0.475	1.957	34.735	0.534	100.000	8.035	34.735	15.050	0.527
	95%ile	0.543	2.446	34.794	0.683	103.510	8.157	34.794	17.795	0.683
	Median	0.475	1.957	34.735	0.534	100.000	8.035	34.735	15.050	0.527

Donabate, Balcarrick Beach Bathing Waters (EPA Beaches.ie)

The Escherichia coli and Intestinal enterococci results for the 2020 sample period are tabled below.

Date	Escherichia coli	Intestinal enterococci	Sample Quality Status
06/09/2021	20	4	Excellent
31/08/2021	<10	2	Excellent
17/08/2021	<10	5	Excellent
03/08/2021	<10	1	Excellent
19/07/2021	<10	15	Excellent
05/07/2021	41	11	Excellent
21/06/2021	10	7	Excellent
08/06/2021	<10	6	Excellent
24/05/2021	<10	2	Excellent

Donabate, Balcarrick Beach achieved "*Excellent*" status for all samples taken during the 2021 bathing season

Malahide Beach

Date	Escherichia coli	Intestinal enterococci	Sample Quality Status
24/05/2021	<10	6	Excellent
08/06/2021	20	23	Excellent
21/06/2021	31	37	Excellent
05/07/2021	<10	5	Excellent
19/07/2021	30	6	Excellent
03/08/2021	602	440	Poor
17/08/2021	1112	85	Poor
31/08/2021	10	1	Excellent
06/09/2021	63	19	Excellent

Although Malahide Beach is no longer classified as a bathing water, it is still monitored during the bathing season. During 2021, seven out of nine samples achieved "Excellent" status and two samples taken during August were assesses as having "poor" status. Follow up samples were taken two days after each of these, and they achieved "excellent" status.

Shellfish Regs (Organics)

Location	Sample Number	FATWT%	CB18	CB31	CB28	CB52	CB44	CB101	CB149	CB118	CB153	CB105
Malahide	ENV-19-1087	1.735	NA	nd	0.112	0.122	NA	0.136	NA	0.137	0.244	0.034

CB138	CB156	CB180	CB170	CB194	CB209	HCBD	HCB	HCHA	HCHG	HCHB	HEPC	HCHD	OCDAN	HCEPC	TNONC	TCDAN
0.244	nd	nd	NA	NA	NA	NA	nd	NA	NA	NA	NA	NA	NA	NA	NA	NA

DDEOP	CCDAN	DDEPP	TDEOP	TDEPP	DDTPP	DDTOP	BDE28	BDE47	BD100	BDE99	BD154	BD153	BD183	NAP	ACNLE	ACNE
NA	NA	0.192	NA	0.116	NA	NA	0.011	0.124	0.041	<0.036	nd	nd	nd	NA	0.147	0.482

FLE	PA	ANT	FLU	PYR	CHR	BAA	BBF	BKF	BAP	ICDP	DBAHA	BGHIP
0.758	3.106	0.119	4.234	2.997	1.706	1.351	2.464	1.104	0.94	0.49	0.811	0.714

Shellfish Regs (Biota)

Year	Date	Sample	Subno	Programme	Station	Latitude	Longitude	Species (latin)	Species (common)	# of individuals	Length Range (mm)	Length Mean (mm)	Length Stdev (mm)	Tissue analysed
2019	06/11/19	1087	1	SWD	Malahide	53.43333	-6.10138	Ensis siliqua	clam, razor	25	137-154	150	3.61	SB

Moisture (%)	Lipid (%)	aluminium (mg kg-1 WW)	arsenic (mg kg-1 WW)	cadmium (mg kg-1 WW)	chromium (mg kg-1 WW)	cobalt (mg kg-1 WW)	copper (mg kg-1 WW)	iron (mg kg-1 WW)	lead (mg kg-1 WW)	manganese (mg kg-1 WW)	mercury (mg kg-1 WW)	nickel (mg kg-1 WW)	selenium (mg kg-1 WW)	silver (mg kg-1 WW)
76.4	1.735	15.1	1.62	0.03	0.09	0.04	1.48	21.6	0.12	0.96	0.01	0.03	0.26	0.1

vanadium (mg kg-1 WW)	zinc (mg kg-1 WW)
0.08	13.2