Environmental Forensics Report of Analysis

Project 20230130

Report #: ***1620***

Date Issued: 09-May-2023

Client Project Reference: Menindee fish kill 9 (24.04.23)

Report Date: 09 May 2023

Customer: Environment Protection Authority

Project Received:25 April 2023

Attention: [redacted]

EF Project Contact: [redacted]

Environmental Forensics
Department of Planning and Environment
Dharug Country
[redacted]

The following samples were analysed:

Sample ID	*Client ID*	*Sample Type*	*Client Sampled Date/Time*	*Aliquot*
232594	SW1	Liquid	24/04/2023 11:30AM	
232598	SW1	Liquid	24/04/2023 11:30AM	Field Aliquot
232602	SW1	Liquid	24/04/2023 11:30AM	Field Aliquot
232606	SW1	Liquid	24/04/2023 11:30AM	Field Aliquot
232610	SW1	Liquid	24/04/2023 11:30AM	Field Aliquot
232614	SW1	Liquid	24/04/2023 11:30AM	Field Aliquot
232618	SW1	Liquid	24/04/2023 11:30AM	Laboratory Aliquot
232595	SW2	Liquid	24/04/2023 9:55AM	
232599	SW2	Liquid	24/04/2023 9:55AM	Field Aliquot
232603	SW2	Liquid	24/04/2023 9:55AM	Field Aliquot
232607	SW2	Liquid	24/04/2023 9:55AM	Field Aliquot
232611	SW2	Liquid	24/04/2023 9:55AM	Field Aliquot
232615	SW2	Liquid	24/04/2023 9:55AM	Field Aliquot
232619	SW2	Liquid	24/04/2023 9:55AM	Laboratory Aliquot
232596	SW3	Liquid	24/04/2023 10:35AM	
232600	SW3	Liquid	24/04/2023 10:35AM	Field Aliquot
232604	SW3	Liquid	24/04/2023 10:35AM	Field Aliquot
232608	SW3	Liquid	24/04/2023 10:35AM	Field Aliquot
232612	SW3	Liquid	24/04/2023 10:35AM	Field Aliquot
232616	SW3	Liquid	24/04/2023 10:35AM	Field Aliquot
232620	SW3	Liquid	24/04/2023 10:35AM	Laboratory Aliquot
232597	SW4	Liquid	24/04/2023 9:58AM	
232601	SW4	Liquid	24/04/2023 9:58AM	Field Aliquot
232605	SW4	Liquid	24/04/2023 9:58AM	Field Aliquot
232609	SW4	Liquid	24/04/2023 9:58AM	Field Aliquot
232613	SW4	Liquid	24/04/2023 9:58AM	Field Aliquot
232617	SW4	Liquid	24/04/2023 9:58AM	Field Aliquot
232621	SW4	Liquid	24/04/2023 9:58AM	Laboratory Aliquot

Report Notes

·This document has been authorised by the person whose name appears in this report.

·This report shall not be reproduced except in full. Samples analysed as received from the client.

·Results reported as 'less than' (<) indicates a result below the practical quantitation limit for the sample matrix and method used.

·Solid samples are reported on a dry weight basis and biota samples are reported on an as received basis unless specified otherwise.

Project Comments

·Samples 232598, 232599, 232600, 232601, 232618, 232619, 232620, 232621, 232606, 232607, 232608, 232609 were sent to ALS Environmental Laboratory (NATA Accreditation no: 825) for the analysis of EK055G: Ammonia as N by Discrete Analyser, EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser, EK061G: Total Kjeldahl Nitrogen By Discrete Analyser, EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser, EK067G: Total Phosphorus as P by Discrete Analyser, EK071G: Reactive Phosphorus as P by discrete analyser, EP030: Biochemical Oxygen Demand (BOD), EP202A: Phenoxyacetic Acid Herbicides by LCMS, EP202S: Phenoxyacetic Acid Herbicide Surrogate, EP204: Glyphosate and AMPA, MW002: Heterotrophic Plate Count, MW006: Faecal Coliforms & E.coli by MF, MW023: Enterococci by Membrane Filtration. This report summarises data from the attached external report: ES2313497, dated 03-May-2023.

·Samples 232614, 232615, 232616 and 232617 were sent to Sydney Water Laboratory Services (NATA accreditation no. 610 and 63) for Algal Identification and Algal Enumeration analyses. Please see detailed results in the attached Phytoplankton Analysis Report no. 284006 dated 5 May 2023.
Samples 232602, 232603, 232604 and 232605 were also sent to Sydney Water Laboratory Services for the analysis of Algal Toxins. Please see the attached Analytical Report no. 284006 dated 5 May 2023, which gives Algal Toxins analysis results and the Algal ID/Enumeration summary results.

Analysis Results - External Methods*
Area - EXTERNAL

Analyte		*Sample ID*	232598	232602	232606	232614	232599	232603	232607	232615	232600	232604	232608	232616
		Start Date	26/04/2023	30/04/2023	26/04/2023	5/05/2023	26/04/2023	30/04/2023	26/04/2023	5/05/2023	26/04/2023	30/04/2023	26/04/2023	5/05/2023
		Client ID	SW1	SW1	SW1	SW1	SW2	SW2	SW2	SW2	SW3	SW3	SW3	SW3
Algal Enumeration	-					RC				RC				RC
Algal Identification	-					RC				RC				RC
Algal Toxins	-		RC				RC				RC			
Ammonia as N	mg/L	<0.01				0.02				0.03				
Biochemical Oxygen Demand	mg/L	<2				<2				<2				
Enterococci	cfu/100mL			12			30					25		
Escherichia coli	cfu/100mL			~64			470					120		
Faecal Coliforms	cfu/100mL			~64			800					130		
Heterotrophic Plate Count (22°C)	cfu/mL			~13000			~29000					~33000		
Heterotrophic Plate Count (36°C)	cfu/mL			~12000			~44000					~>57000		
Nitrite+Nitrate as N	mg/L	<0.01				0.01				0.02				
Reactive Phosphorus as P	mg/L	0.02				0.02				0.01				
Total Kjeldahl Nitrogen as N	mg/L	1.4				1.5				1.6				
Total Nitrogen as N	mg/L	1.4				1.5				1.6				
Total Phosphorus as P	mg/L	0.17				0.18				0.2				

Analysis Results - External Methods*
Area - EXTERNAL

Analyte		*Sample ID* / *Start Date* / *Client ID*			
		232601 26/04/2023 SW4	**232605 30/04/2023 SW4**	**232609 26/04/2023 SW4**	**232617 5/05/2023 SW4**
Algal Enumeration	-				RC
Algal Identification	-				RC
Algal Toxins	-		RC		
Ammonia as N	mg/L	0.03			
Biochemical Oxygen Demand	mg/L	<2			
Enterococci	cfu/100mL			35	
Escherichia coli	cfu/100mL			320	
Faecal Coliforms	cfu/100mL			840	
Heterotrophic Plate Count (22°C)	cfu/mL			~40000	
Heterotrophic Plate Count (36°C)	cfu/mL			~>57000	
Nitrite+Nitrate as N	mg/L	0.01			
Reactive Phosphorus as P	mg/L	0.01			
Total Kjeldahl Nitrogen as N	mg/L	1.5			
Total Nitrogen as N	mg/L	1.5			
Total Phosphorus as P	mg/L	0.2			

Analysis Results - External Methods*
Area - EXTERNAL

Analyte		*Sample ID* / *Start Date* / *Client ID*			
		232618 26/04/2023 SW1	**232619 26/04/2023 SW2**	**232620 26/04/2023 SW3**	**232621 26/04/2023 SW4**
2.4.5-T	µg/L	<10	<10	<10	<10
2.4.6-T	µg/L	<10	<10	<10	<10
2.4-D	µg/L	<10	<10	<10	<10
2.4-DB	µg/L	<10	<10	<10	<10
2.4-DP	µg/L	<10	<10	<10	<10
2.6-D	µg/L	<10	<10	<10	<10
4-Chlorophenoxy acetic acid	µg/L	<10	<10	<10	<10
AMPA	µg/L	<10	<10	<10	<10
Clopyralid	µg/L	<10	<10	<10	<10
Dicamba	µg/L	<10	<10	<10	<10
Fluroxypyr	µg/L	<10	<10	<10	<10
Glyphosate	µg/L	<10	<10	<10	<10
MCPA	µg/L	<10	<10	<10	<10
MCPB	µg/L	<10	<10	<10	<10
Mecoprop	µg/L	<10	<10	<10	<10
Picloram	µg/L	<10	<10	<10	<10
Silvex (2.4.5-TP/Fenoprop)	µg/L	<10	<10	<10	<10
Triclopyr	µg/L	<10	<10	<10	<10

Analysis Results - ICVAASW **Area - INORGANIC** *Analyte*		*Sample ID* *Start Date* *Client ID*	**232610** **28/04/2023** **SW1**	**232611** **28/04/2023** **SW2**	**232612** **28/04/2023** **SW3**	**232613** **28/04/2023** **SW4**
Mercury	µg/L		<0.05	<0.05	<0.05	<0.05

Analysis Results - ICPAES **Area - INORGANIC** *Analyte*		*Sample ID* *Start Date* *Client ID*	**232610** **26/04/2023** **SW1**	**232611** **26/04/2023** **SW2**	**232612** **26/04/2023** **SW3**	**232613** **26/04/2023** **SW4**
Aluminium (Lab. filtered)	mg/L		<0.04	<0.04	<0.04	<0.04
Barium (Lab. filtered)	mg/L		0.13	0.13	0.13	0.13
Boron (Lab. filtered)	mg/L		<0.1	<0.1	<0.1	<0.1
Calcium (Lab. filtered)	mg/L		38	39	39	38
Iron (Lab. filtered)	mg/L		<0.1	<0.1	<0.1	<0.1
Magnesium (Lab. filtered)	mg/L		19	20	20	19
Potassium (Lab. filtered)	mg/L		11	12	12	11
Sodium (Lab. filtered)	mg/L		49	49	51	50
Strontium (Lab. filtered)	mg/L		0.43	0.44	0.44	0.43
Sulfur (Lab. filtered)	mg/L		4.0	4.0	4.1	4.0
Titanium (Lab. filtered)	mg/L		<0.01	<0.01	<0.01	<0.01

Analysis Results - ICPMS
Area - INORGANIC

Analyte		*Sample ID* 232610	232611	232612	232613
		Start Date 25/04/2023	25/04/2023	25/04/2023	25/04/2023
		Client ID SW1	SW2	SW3	SW4
Antimony (Lab. filtered)	mg/L	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic (Lab. filtered)	mg/L	0.002	0.002	0.002	0.002
Beryllium (Lab. filtered)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Cadmium (Lab. filtered)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (Lab. filtered)	mg/L	<0.001	<0.001	<0.001	<0.001
Cobalt (Lab. filtered)	mg/L	0.0003	0.0002	0.0002	0.0002
Copper (Lab. filtered)	mg/L	0.0014	0.0013	0.0010	0.0011
Lead (Lab. filtered)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Lithium (Lab. filtered)	mg/L	0.0019	0.0019	0.0019	0.0018
Manganese (Lab. filtered)	mg/L	<0.001	<0.001	<0.001	<0.001
Molybdenum (Lab. filtered)	mg/L	0.0016	0.0015	0.0015	0.0016
Nickel (Lab. filtered)	mg/L	0.0031	0.0031	0.0028	0.0030
Selenium (Lab. filtered)	mg/L	<0.005	<0.005	<0.005	<0.005
Silver (Lab. filtered)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Thallium (Lab. filtered)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Tin (Lab. filtered)	mg/L	<0.0002	<0.0002	<0.0002	<0.0002
Vanadium (Lab. filtered)	mg/L	0.0057	0.0051	0.0047	0.0052
Zinc (Lab. filtered)	mg/L	<0.001	<0.001	<0.001	<0.001

Analysis Results - ICPAES
Area - INORGANIC

Analyte		*Sample ID* 232610	232611	232612	232613
		Start Date 26/04/2023	26/04/2023	26/04/2023	26/04/2023
		Client ID SW1	SW2	SW3	SW4
Aluminium (acid extractable)	mg/L	2.7	2.6	3.8	2.4
Barium (acid extractable)	mg/L	0.16	0.15	0.16	0.16
Boron (acid extractable)	mg/L	<0.1	<0.1	<0.1	<0.1
Calcium (acid extractable)	mg/L	42	40	40	41
Iron (acid extractable)	mg/L	2.2	2.2	3.1	2.0
Magnesium (acid extractable)	mg/L	20	20	21	21
Manganese (acid extractable)	mg/L	0.15	0.16	0.19	0.15
Potassium (acid extractable)	mg/L	12	12	13	13
Sodium (acid extractable)	mg/L	51	49	52	53
Strontium (acid extractable)	mg/L	0.46	0.45	0.46	0.46
Sulfur (acid extractable)	mg/L	4.1	4.2	4.2	4.3
Titanium (acid extractable)	mg/L	0.05	0.05	0.07	0.05

Analysis Results - ICPMS

Area - INORGANIC

Analyte		*Sample ID*	232610	232611	232612	232613
		Start Date	25/04/2023	25/04/2023	25/04/2023	25/04/2023
		Client ID	SW1	SW2	SW3	SW4
Antimony (acid extractable)	mg/L		<0.0005	<0.0005	<0.0005	<0.0005
Arsenic (acid extractable)	mg/L		0.003	0.003	0.003	0.003
Beryllium (acid extractable)	mg/L		<0.0001	<0.0001	0.0001	<0.0001
Cadmium (acid extractable)	mg/L		<0.0001	<0.0001	<0.0001	<0.0001
Chromium (acid extractable)	mg/L		0.003	0.003	0.004	0.002
Cobalt (acid extractable)	mg/L		0.0016	0.0017	0.0020	0.0015
Copper (acid extractable)	mg/L		0.0029	0.0029	0.0033	0.0024
Lead (acid extractable)	mg/L		0.0010	0.0013	0.0014	0.0011
Lithium (acid extractable)	mg/L		0.0025	0.0025	0.0028	0.0025
Molybdenum (acid extractable)	mg/L		0.0017	0.0015	0.0015	0.0016
Nickel (acid extractable)	mg/L		0.0048	0.0049	0.0055	0.0046
Selenium (acid extractable)	mg/L		<0.005	<0.005	<0.005	<0.005
Silver (acid extractable)	mg/L		<0.0001	<0.0001	<0.0001	<0.0001
Thallium (acid extractable)	mg/L		<0.0001	<0.0001	<0.0001	<0.0001
Tin (acid extractable)	mg/L		<0.0002	<0.0002	<0.0002	<0.0002
Vanadium (acid extractable)	mg/L		0.011	0.011	0.013	0.011
Zinc (acid extractable)	mg/L		0.005	0.005	0.006	0.004

Analysis Results - QQQPEST

Area - ORGANIC

Analyte		Sample ID Start Date Client ID	232594 26/04/2023 SW1	232595 26/04/2023 SW2	232596 26/04/2023 SW3	232597 26/04/2023 SW4
Aldrin	µg/L		<0.3	<0.3	<0.3	<0.3
Allethrin	µg/L		<0.5	<0.5	<0.5	<0.5
Alpha-Chlordane	µg/L		<0.4	<0.4	<0.4	<0.4
alpha-HCH	µg/L		<0.4	<0.4	<0.4	<0.4
Ametryn	µg/L		<0.5	<0.5	<0.5	<0.5
Atraton	µg/L		<0.5	<0.5	<0.5	<0.5
Atrazine	µg/L		<0.5	<0.5	<0.5	<0.5
beta-HCH	µg/L		<0.5	<0.5	<0.5	<0.5
Bifenthrin	µg/L		<0.5	<0.5	<0.5	<0.5
Bioresmethrin	µg/L		<0.3	<0.3	<0.3	<0.3
Carbophenothion	µg/L		<0.5	<0.5	<0.5	<0.5
Chlorpyrifos	µg/L		<0.4	<0.4	<0.4	<0.4
Cis-permethrin	µg/L		<0.3	<0.3	<0.3	<0.3
Crotoxyphos	µg/L		<0.5	<0.5	<0.5	<0.5
Cyfluthrin	µg/L		<0.5	<0.5	<0.5	<0.5
Cypermethrin	µg/L		<0.5	<0.5	<0.5	<0.5
delta-HCH	µg/L		<0.5	<0.5	<0.5	<0.5
Deltamethrin	µg/L		<0.5	<0.5	<0.5	<0.5
Diazinon	µg/L		<0.5	<0.5	<0.5	<0.5
Dichlorvos	µg/L		<0.4	<0.4	<0.4	<0.4
Dieldrin	µg/L		<0.5	<0.5	<0.5	<0.5
Dimethoate	µg/L		<0.5	<0.5	<0.5	<0.5
Endosulfan II	µg/L		<1.0	<1.0	<1.0	<1.0
Endosulfan I	µg/L		<0.9	<0.9	<0.9	<0.9
Endosulfan Sulfate	µg/L		<1.0	<1.0	<1.0	<1.0
Endrin Aldehyde	µg/L		<0.5	<0.5	<0.5	<0.5
Endrin Ketone	µg/L		<0.5	<0.5	<0.5	<0.5
Endrin	µg/L		<0.5	<0.5	<0.5	<0.5
Ethion	µg/L		<0.5	<0.5	<0.5	<0.5
Fenamiphos	µg/L		<0.5	<0.5	<0.5	<0.5
Fenitrothion	µg/L		<0.5	<0.5	<0.5	<0.5
Fenthion	µg/L		<0.4	<0.4	<0.4	<0.4

Tests not covered by NATA accreditation 3040 are denoted with *

Codes: **SN =** Sample Note **RN =** Result Note **RC =** Project Comment

Analysis Results - QQQPEST

Area - ORGANIC

Analyte		Sample ID Start Date Client ID	232594 26/04/2023 SW1	232595 26/04/2023 SW2	232596 26/04/2023 SW3	232597 26/04/2023 SW4
Fenvalerate	µg/L		<0.5	<0.5	<0.5	<0.5
Gamma-Chlordane	µg/L		<0.4	<0.4	<0.4	<0.4
gamma-HCH	µg/L		<0.4	<0.4	<0.4	<0.4
Heptachlor Epoxide	µg/L		<0.5	<0.5	<0.5	<0.5
Heptachlor	µg/L		<0.4	<0.4	<0.4	<0.4
Hexachlorobenzene	µg/L		<0.3	<0.3	<0.3	<0.3
Hexazinone	µg/L		<0.5	<0.5	<0.5	<0.5
L-cyhalothrin	µg/L		<0.5	<0.5	<0.5	<0.5
Malathion	µg/L		<0.5	<0.5	<0.5	<0.5
Methidathion	µg/L		<0.5	<0.5	<0.5	<0.5
Methyl Azinphos	µg/L		<0.4	<0.4	<0.4	<0.4
Methyl Chlorpyrifos	µg/L		<0.4	<0.4	<0.4	<0.4
Methyl Parathion	µg/L		<0.5	<0.5	<0.5	<0.5
Mevinphos	µg/L		<0.4	<0.4	<0.4	<0.4
Oxyfluorfen	µg/L		<0.5	<0.5	<0.5	<0.5
Parathion	µg/L		<0.5	<0.5	<0.5	<0.5
Phorate	µg/L		<0.4	<0.4	<0.4	<0.4
Profenofos	µg/L		<0.5	<0.5	<0.5	<0.5
Prometon	µg/L		<0.5	<0.5	<0.5	<0.5
Prometryn	µg/L		<0.5	<0.5	<0.5	<0.5
Propargite	µg/L		<0.5	<0.5	<0.5	<0.5
Propazine	µg/L		<0.5	<0.5	<0.5	<0.5
Propetamphos	µg/L		<0.5	<0.5	<0.5	<0.5
Simazine	µg/L		<0.5	<0.5	<0.5	<0.5
Simetryn	µg/L		<0.5	<0.5	<0.5	<0.5
Sulprofos	µg/L		<0.4	<0.4	<0.4	<0.4
Tebuconazole	µg/L		<0.5	<0.5	<0.5	<0.5
Tebuthiuron	µg/L		<0.5	<0.5	<0.5	<0.5
Terbuthylazine	µg/L		<0.5	<0.5	<0.5	<0.5
Terbutryn	µg/L		<0.5	<0.5	<0.5	<0.5
Tetrachlorvinphos	µg/L		<0.5	<0.5	<0.5	<0.5
Trans-permethrin	µg/L		<0.7	<0.7	<0.7	<0.7

Tests not covered by NATA accreditation 3040 are denoted with *

Codes: **SN =** Sample Note **RN =** Result Note **RC =** Project Comment

Area - ORGANIC

Sample ID	Client ID	Method	Start Date	Result
232594	SW1	OLCSCAN* - LC/MS Scan	28/04/2023	LC/MS scan for approximately 600 pesticides was negative. A list of analysed compounds can be provided on request. Note the list doesn't include glyphosate and quaternary ammonium herbicides (e.g. Paraquat and Diquat).
232595	SW2	OLCSCAN* - LC/MS Scan	28/04/2023	LC/MS scan for approximately 600 pesticides was negative. A list of analysed compounds can be provided on request. Note the list doesn't include glyphosate and quaternary ammonium herbicides (e.g. Paraquat and Diquat).
232596	SW3	OLCSCAN* - LC/MS Scan	28/04/2023	LC/MS scan for approximately 600 pesticides was negative. A list of analysed compounds can be provided on request. Note the list doesn't include glyphosate and quaternary ammonium herbicides (e.g. Paraquat and Diquat).
232597	SW4	OLCSCAN* - LC/MS Scan	28/04/2023	LC/MS scan for approximately 600 pesticides was negative. A list of analysed compounds can be provided on request. Note the list doesn't include glyphosate and quaternary ammonium herbicides (e.g. Paraquat and Diquat).

The sample(s) referred to in this report were analysed by the following method(s):

Method code	*Method description*	*Area*
External Methods*	External Methods - Analysis completed externally	EXTERNAL
External Methods*	External Methods - Analysis completed externally	EXTERNAL
ICVAASW	Mercury by Cold Vapour Atomic Absortion Spectroscopy	INORGANIC
ICPAES	Dissolved element analysis by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICPAES)	INORGANIC
ICPMS	Dissolved Metals by Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	INORGANIC
ICPAES	Acid extractable element analysis by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICPAES)	INORGANIC
ICPMS	Acid extractable Metals by Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	INORGANIC
QQQPEST	Determination of Multiresidue Pesticides by GCMSMS	ORGANIC
OLCSCAN*	Qualitative LC/MS scan	ORGANIC

The results in this report were authorised by:

Name	*Title*	*Area*
[redacted]	**Senior Scientist**	EXTERNAL
	Scientist	INORGANIC
	Scientist	ORGANIC

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Codes: **SN =** Sample Note **RN =** Result Note **RC =** Project Comment