

ENVIRONMENTAL MONITORING

REPORT 2019

BIDGEE BANKS GOLF COURSE

2018 / 2019

JOB NO: 6029

The background of the report cover is a composite image. The top right portion shows a green field with a large, complex irrigation system (center pivot) in operation, with water spraying from multiple points. The bottom left portion is an aerial view of a dirt road and surrounding land, with a white van parked on the road. The text is overlaid on these images.

DM McMahon Pty Ltd
6 Jones Street (PO Box 6118)
Wagga Wagga NSW 2650

t (02) 6931 0510
www.dmmcmahon.com.au

COOTAMUNDRA GUNDAGAI REGIONAL COUNCIL ENVIRONMENTAL MONITORING BIDGEE BANKS GOLF COURSE

May 2019

Project brief

This report presents the results of the 2018/2019 environmental monitoring of the use of effluent for irrigation at the Bidgee Banks Golf Course Gundagai NSW 2722. The document provides information about the site, soil and water conditions from field observations and laboratory analysis.

Site identification

Address: 255 Sheridan Street Gundagai NSW 2722
Real property description: Park Land – Carberry Park
Centre co-ordinate: E600458 N6119479 MGA GDA z55
Local Government Area: Cootamundra Gundagai Regional Council
Owner: Cootamundra Gundagai Regional Council
Operator: Cootamundra Gundagai Regional Council
Present use: Parkland & Golf Course
Report reference number: 6029

Document Control

Role	Name	Signed	Date	Revision
Author	Zach Bradley BEnvSc MALGA		9/05/19	00
Author and reviewer	David McMahon CEnvP BAppSc SA GradDip WRM MEnvMgmt MALGA MEIANZ MSSA		9/05/19	00

Contents

1.0 Introduction	4
2.0 Seasonal Conditions	4
3.0 Results	5
3.1 Soil	5
3.2 Effluent	9
3.3 Groundwater	10
4.0 Nutrient Loading	12
4.1 Calculating maximum nutrient loading rates	12
5.0 Conclusion & Recommendation	14
6.0 References	15
7.0 Disclaimer	15
8.0 Notice of Copyright	15
9.0 Attachments	16

List of Tables

Table 1: Gundagai weather data April 2018 to April 2019	4
Table 2: Gundagai long term average weather data	4
Table 3: Soil analysis parameters	5
Table 4: Topsoil analysis	6
Table 5: Subsoil analysis	7
Table 6: Effluent analysis 2018/19	9
Table 7: Classification of effluent	10
Table 8: Groundwater analysis 2018/19	11
Table 9: Nutrient mass balance	12
Table 10: Phosphorus calculations	13
Table 11: Nitrogen calculations	13
Table 12: Crop nutrient uptake and actual nutrient application 2018/19	13
Table 13: Recommended effluent application rates (ML/ha)	14

List of Figures

Figure 1: Historical topsoil phosphorus levels	8
Figure 2: Historical topsoil ESP levels	8

Attachments

Certificates of Analysis	Attachment A
Laboratory Chain of Custodies	Attachment B

1.0 Introduction

Environmental monitoring is carried out at the Bidgee Banks Golf Course for Cootamundra Gundagai Regional Council to monitor the effects of irrigating soils with treated effluent. The golf course is approximately 20 hectares in area and approximately 41.14 Megalitres (ML) of effluent was irrigated in the 2018/19 irrigation season. Irrigation occurs on a demand basis usually from late spring throughout summer and into early autumn. The effluent source is the municipal Wastewater Treatment Plant (WTP). The effluent is treated at the WTP where it is stored in a primary pond for 25 days before being released into a storage lagoon for irrigation.

2.0 Seasonal Conditions

Total rainfall for the irrigation season (October 2018 to April 2019) was below average for all months except March 2019. Temperature conditions varied with all monthly mean maximum temperatures except February and March at or above long-term averages, and monthly mean minimum temperatures below long-term averages through winter and above in all other months. Weather data was sourced from BOM Station 073141, Nangus Road Gundagai. Long term data was sourced from BOM Station 073128 Ridge Street Gundagai. The long-term average was collected between 1976 to 1995. Due to a lack of results for average minimum temperature, gridded point data was sourced from SILO datadrill.

Table 1: Gundagai weather data April 2018 to April 2019

Month	Average Minimum Temperature 2018/2019	Average Maximum Temperature 2018/2019	Total Rainfall 2018/2019
April 2018	10.3	27.0	9.5
May 2018	3.9	18.4	31.4
June 2018	3.1	15.0	47.8
July 2018	0.7	13.6	17.0
August 2018	2.2	14.9	36.4
September 2018	3.4	19.4	29.6
October 2018	9.3	25.7	14.7
November 2018	12.3	25.9	45.8
December 2018	16.5	32.2	52.2
January 2019	21.1	37.2	53.0
February 2019	16.2	31.2	10.6
March 2019	15.4	27.6	65.8
April 2019	10.2	25.0	0.0

Table 2: Gundagai long term average weather data

Month	Average Minimum Temperature Long Term	Average Maximum Temperature Long Term	Average Rainfall Long Term
April	8.7	22.8	54.9
May	6.0	18.0	67.7
June	3.2	13.6	60.3
July	2.0	12.8	78.6
August	3.1	14.9	63.2
September	5.1	17.6	68.4
October	7.5	21.7	69.2
November	10.3	25.8	49.5
December	13.1	29.2	52.3
January	15.0	31.6	65.8
February	15.6	31.4	41.1
March	12.9	27.8	43.6

3.0 Results

3.1 Soil

Soil sampling is conducted annually at the end of the irrigation season to gauge any change in soil physical and nutrient status. Sampling was undertaken on 10 April 2019.

Historically, the soil has been sampled at 0-10cm and 50-60cm for a full suite of analytes. However, the soil program was modified in 2007 to satisfy the DEC 2004 (Formerly NSW EPA) environmental guidelines as outlined in the publication *Use of Effluent by Irrigation*.

The current sampling locations have been maintained with the sampling depths extended to four increments (0-10cm, 10-30cm, 30-60cm and 60-100cm). In addition to the parameters that have historically been tested, the topsoil analysis suite now also includes Total Phosphorus (TP) and Total Kjeldahl Nitrogen (TKN). Subsoil analysis has been limited to pH, EC, Nitrate as N and TP, Table 3. The guidelines recommend that subsoil analysis be carried out for less analytes but with more attention to depth increments.

All samples are sent to the Environmental and Analytical Laboratories (EAL) at Charles Sturt University for analysis. Samples from 0-10cm are also sent to Incitec Pivot Laboratories, Werribee, for comprehensive analysis. Both laboratories are NATA accredited.

Table 3: Soil analysis parameters

Depth	Analysis
0-10cm	Total Phosphorus, Total Kjeldahl Nitrogen, Nitrate, Phosphorus (Colwell), Phosphorus Buffer Index, Conductivity, Chloride, pH, Sulphur, Cation Exchange Capacity
10-30cm	Conductivity, Nitrate as N, Total Phosphorus, pH
30-60cm	Conductivity, Nitrate as N, Total Phosphorus, pH
60-100cm	Conductivity, Nitrate as N, Total Phosphorus, pH

Fairways 8 and 5 were chosen as soil sampling sites in order to obtain a cross-section of the soils at the Gundagai Golf Course. Fairway 8 is on the northern side of the course and on slightly higher ground than Fairway 5, which is adjacent to the Murrumbidgee River. A site where no irrigation occurs, on the south-eastern end of Fairway 6, was chosen as a soil testing control for comparison of readily monitored changes in the irrigated sites. Soils are typically well drained alluvial grey-brown silty loams to clay loams. A GPS (Global Positioning System) is used to log soil sample locations for monitoring and site management.

All the soils sampled are well-drained river loams. The soils demonstrate structure and an abundance of organic material (i.e. roots) down to the sampled depth. The soils appeared to be in good physical condition with the absence of any pans or water logging.

Topsoil and subsoil sampling were undertaken on 10 May 2019 and results can be seen in the following Tables 4 and 5.

Table 4: Topsoil analysis

Parameter	Desirable Range	Fairway 5	Fairway 8	Non-Irrigated
Phosphorus Total (mg/kg)	>30 ³	474	701	438
Total Kjeldahl Nitrogen (mg/kg)	>200 ¹	2940	3190	2350
Nitrate Nitrogen (ppm)	>30 ³	70	18	16
Phosphorus Colwell (ppm)	>30 ³	65	190	48
P Buffer Index (PBI)	> 30 ⁴	48	88	55
Available K (ppm)	> 225 ⁵	310	560	300
Available Sulphur KCl (ppm)	>10 ¹	14	22	6
EC (dS/m)	<0.5 ¹	0.20	0.19	0.09
ECe (dS/m)	<2 ¹	1.60	1.5	0.7
Organic C (% C)	2 ¹	2.7	3.4	2.5
Chloride (ppm)	< 125 ⁴	42	57	11
pH (H ₂ O)	6 - 8 ¹	5.8	6.3	6.3
pH (CaCl ₂)	5.5 - 7 ¹	5.2	5.7	5.5
CEC (meq/100gm)	5 - 15 ¹	13.3	17.0	12.3
Aluminium (meq/100gm)	<1 ²	<0.1	<0.1	<0.1
Calcium (meq/100gm)	n/a	9.1	9.4	8.9
Magnesium (meq/100gm)	n/a	3.3	5.7	2.5
Sodium (meq/100gm)	<4.3 ²	0.09	0.45	0.14
Potassium (meq/100gm)	<i>no data</i>	0.78	1.40	0.76
Ca:Mg Ratio	>2 ¹	2.8	1.6	3.6
K:Mg Ratio	<i>no data</i>	-	-	-
Aluminium %	<5% ¹	<1.0	<1.0	<1.0
Calcium %	65-80% ¹	68.0	55.0	73.0
Magnesium %	10-15% ¹	25.0	34.0	20.0
Sodium %	<5% ¹	0.65	2.60	1.10
Potassium %	1-5% ¹	5.90	8.40	6.20

Table 5: Subsoil analysis

Depth	Parameter	Desirable Range	Fairway 5	Fairway 8	Non-Irrigated
10-30cm	Conductivity (µS/cm)	<500	56	53	35
	Nitrate as N (mg/kg)	>30 ³	12	<1	5
	Phosphorus Total (mg/kg)	>30 ³	325	472	351
	pH (H ₂ O)	6 - 8 ¹	6.6	6.9	6.9
30-60cm	Conductivity (µS/cm)	<500 ¹	39	59	26
	Nitrate as N (mg/kg)	>30 ³	6	<1	2
	Phosphorus Total (mg/kg)	>30 ³	392	512	332
	pH (H ₂ O)	6 - 8 ¹	6.8	6.8	7.2
60-100cm	Conductivity (µS/cm)	<500 ¹	30	59	24
	Nitrate as N (mg/kg)	>30 ³	3	<1	1
	Phosphorus Total (mg/kg)	>30 ³	465	489	346
	pH (H ₂ O)	6 - 8 ¹	7.1	6.8	7.3

1. NSW Agriculture (1998)
2. Charman & Murphy (1991)
3. Gunter (1997)
4. Peverill, Sparrow & Reuter (1999)
5. Incitec Fertilisers et al. Technical Bulletin

Subsoils

The majority of subsoil parameter levels have decreased from the previous year with most notable changes occurring in the 10-30cm depth, however, the control area results have also decreased similar to that of the irrigated fairways.

Nitrate nitrogen levels have decreased at the majority of depths and sample points with control values residing between results for fairways at all depths. Conductivity has decreased at all sites and depths from last year's results.

Phosphorus and pH levels have remained steady at all sites and depths apart from a decrease in phosphorus levels at fairway 5 at the depth of 10-30 after a high reading last year.

Topsoils

Topsoil results from the previous year recorded decreases across all three locations for total phosphorus, Colwell phosphorus and Kjeldahl nitrogen as seen in Table 4.

Although the fairways have recorded decreases for some parameters in topsoils, the control results were similar in changes from the previous year.

Nitrate nitrogen as had an increase at fairway 5 to a historical high of 70mg/kg, up from 15mg/kg last year, which is contributing to an overall slight increase since monitoring began in 1999. Chloride levels have more than halved over the last year at both fairways and the control area, this contradicts the overall slight increasing trend in chloride levels since 2010.

pH and CEC levels were fairly consistent across all sites which correlates with a steady level trend started in 2013.

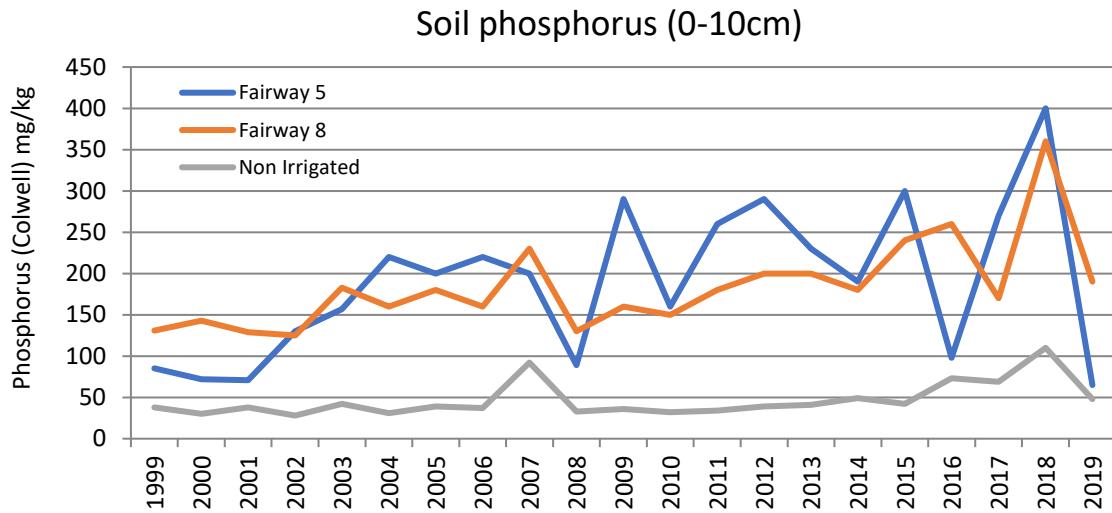


Figure 1: Historical topsoil phosphorus levels

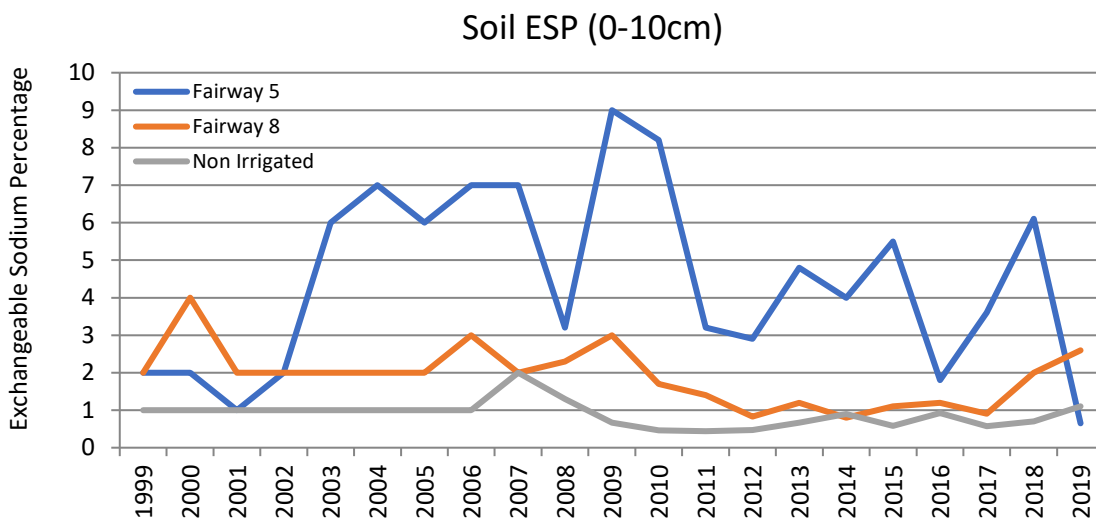


Figure 2: Historical topsoil ESP levels

3.2 Effluent

Four water samples for the 2018/19 irrigation season were collected. Samples were collected on 15 October 2018, 14 December 2018, 13 February 2019 and 11 April 2019. Samples are collected from the irrigation pump head with the pump running.

Water samples are analysed for BOD, Faecal Coliforms, Conductivity, Total Nitrogen, Oil & Grease, Total Phosphorus, pH, Sodium Adsorption Ratio and Total Suspended Solids, as shown in Table 6.

Table 6: Effluent analysis 2018/19

Pollutant	Desirable Level	15/10/18	14/12/18	13/2/19	11/4/19	Mean
BOD mg/L	<40 ²	8	25	23	9	16
Conductivity µS/cm	280 - 800	797	585	493	533	602
Faecal Coliforms cfu/100ml	< 1000	45	6160	50	734	1747
Oil & Grease mg/L	<5	3	3	3	1	2.5
pH	6.5-8.0	7.8	8.4	7.4	7.5	7.8
Phosphorus (total) mg/L	<10	7.16	8.77	4.67	3.14	5.94
Sodium Adsorption Ratio	<6	3	3	4	4	3.5
Nitrogen (total) mg/L	<50	39	32	12	23	27
Total Suspended Solids mg/L	N/A	7	73	74	33	47
Comments						
Water Quality	-	Fair	Fair	Fair	Fair	-
Particulate Matter	-	None	None	None	None	-
Weather	-	Fine & Cool	Fine & Warm	Fine & Warm	Fine & Warm	-

ANZECC (2000), 2. DEC NSW (2004), 3. EPA NSW (1995).

Previously, the long-term trend for phosphorus has been a steady decline, in recent years however, phosphorus has increased. Although an increase has been noted the phosphorus levels for the current monitoring period have been within historical ranges and within desirable levels.

The Sodium Adsorption Ratio has not changed significantly over the last seven years, which is an indication that the magnesium and calcium cations are in balance with the elevated sodium levels. The Sodium Adsorption Ratio (SAR) has been ranging from 1-5 in that time and between 3-4 during the current monitoring period. The potentially harmful level for irrigated effluent is <6, as outlined in the guidelines, DEC 2004.

Since 1999 pH levels have been steadily increasing, however in the last monitoring period pH has decreased to a more neutral reading following a slightly declining trend since 2015. pH should be continued to be monitored over the next few years to help stabilise levels between 6.5 – 8 as indicated in Table 6.

Faecal coliform levels have been highly variable throughout the monitoring period as a result of a prolonged plant upgrade period as determined from environmental monitoring and individual testing. The ANZECC 2000 guideline (<150 fc/100ml) for primary contact (swimming etc) and secondary contact (boating, fishing etc) is <1,000fc/100ml. A historically high reading of 6160cfu/100ml was recorded in the December 2018 monitoring schedule which has since declined.

Effluent salinity was very stable throughout the year apart from a higher reading in October 2018 which is very similar to last year and could have been caused by lack/excess of dilution from high variances in rainfall.

The sampled water is classed as low strength effluent for irrigation in relation to the DEC guidelines as seen below in Table 7.

Table 7: Classification of effluent

Constituent	Strength (average concentration mg/L)			
	Effluent 2018/2019	Low	Medium	High
Total Nitrogen	26.50	<50	50-100	>100
Total Phosphorus	5.94	<10	10-20	>20
Total Suspended Solids	46.75	<600	600-1,000	>1,000-2,500

For the purpose of comparison, TDS has been calculated from EC based on the assumption that 1000 EC (µS/cm) = 640ppm TDS.

3.3 Groundwater

One groundwater sample was collected on the 11 April 2019 from the two piezometers that are located in the vicinity of fairways 17 and 7 respectively.

Piezometer number one, located on Fairway 17, had a Standing Water Level (SWL) of -4.33 metres below ground level, however, was unable to be sampled due to a lack of liquid in the piezo.

The previously destroyed Piezometer 2 was reconstructed two days before the sampling took place in a location immediately adjacent to the former piezo site. Piezo 2 had a SWL of -4.55 metres below ground level.

The groundwater sample was analysed for BOD, Conductivity, Total Nitrogen, Oil & Grease, Total Phosphorus, pH, Sodium Adsorption Ratio and TSS, Table 8.

Table 8: Groundwater analysis 2018/19

Pollutant	Desirable Level	Piezometer 1	Piezometer 2
BOD mg/L	<40 ²	I/S	10
Conductivity µS/cm	280 - 800 ¹	I/S	718
Oil & Grease mg/L	<5 ³	I/S	3
pH	6.5-8.0 ¹	I/S	7.1
Phosphorus (total) mg/L	<10 ²	I/S	8.23
Sodium Adsorption Ratio	<6 ³	I/S	2
Nitrogen (total) mg/L	<50 ²	I/S	22
Total Suspended Solids mg/L	n/a	I/S	34300
Comments			
Water Quality	n/a	I/S	Brownish Grey Colour
Particulate Matter	n/a	I/S	Sediment
Weather	n/a	I/S	Fine & Warm

1. ANZECC (2000) *Australian & New Zealand Guidelines for Fresh & Marine Water Quality*.

2. DEC NSW (2004) *Use of Effluent by Irrigation, Environmental Guidelines*

I/S Insufficient sample

The conductivity readings in the piezometer are below the threshold level of 800 µs/cm and is a slight increase after a previously steadily declining trend first noted in 2012/2013. The water in the piezometer generally has a very poor replenishment rate when emptied. The water is usually very dirty and appears to not have a high degree of connectivity to the river system at the drilled depth.

4.0 Nutrient Loading

In the 2018/19 irrigation season approximately 41,140^k kilolitres (41.14^k ML) of effluent was irrigated over an area of approximately 20 hectares. Maximum nutrient loading rates are calculated annually to compare nutrient concentrations in irrigated effluent with the anticipated crop uptake of nutrients. Annual soil analysis is also carried out to correlate the theoretical loading rates with actual nutrient levels in the soil. Table 9 shows the nutrient mass balance incorporating average effluent quality and quantities applied.

Table 9: *Nutrient mass balance*

Parameter	Effluent Quality (Mean value)	Nutrient Loading*	Nutrient Removal	Nutrient Balance
	mg/L	kg/ha/yr	kg/ha/yr	kg/ha/yr
Nitrogen	26.50	54.5	130	-75.5
Phosphorus	5.94	12.2	16	-3.8

**Based on irrigating 2057 KL/ha/yr*

The nutrient mass balance indicates that for perennial pasture the nitrogen and phosphorus supply in the effluent irrigation is below the anticipated crop uptake. Processes such as mineralization, fixation from legumes (clover) and fertilising will boost nitrogen supply to more desirable levels for healthy plants.

4.1 Calculating maximum nutrient loading rates

The following equation is used to determine irrigation area requirements when using treated effluent to water pastures (EPA 1995).

$$A = \frac{C * Q}{L_c}$$

A = the irrigation area (hectares)

C = concentration of constituents (milligrams per litre)

Q = average effluent flow rate (kilolitres per day)

L_c = critical loading rate of constituent (kilograms per hectare per day)

This formula can be rearranged to determine the recommended effluent flow rate in kilolitres per day over the entire 20 hectares.

$$Q = \frac{A * 1000 * L_c}{C}$$

^k – Irrigation loads were calculated on the basis of 220,000L a day over 20 Ha, the irrigation season for this load was identified as the time between the first and last sample taken which was derived from last year's monitoring period, being 187 days.

The amount of effluent that can be applied to perennial pasture has been calculated for minimum, average and maximum nutrient levels in the irrigated effluent. The amounts of effluent (Q) that can be applied for the different nutrient levels can be seen in Tables 10 and 11. The values have been calculated in kilolitres per hectare per year.

Table 10: Phosphorus calculations

Phosphorus Concentration Ranges	Min	Average	Max
C - concentration phosphorus in effluent mg/L	3.1	5.9	8.8
L_c - critical loading rate of phosphorus kg/ha/year	16.0	16.0	16.0
A - The irrigation area (hectares)	20.0	20.0	20.0
Q - Average effluent flow rate kL/ha/year	1824.4	2695.9	5095.5
Actual amount of effluent irrigated kL/ha/year	2057.0	2057.0	2057.0
Actual Phosphorus applied in effluent (load) kg/ha	6.5	12.2	18.0

Table 11: Nitrogen calculations

Nitrogen Concentration Ranges	Min	Average	Max
C - concentration of nitrogen in effluent mg/L	12.0	26.5	39.0
L_c - critical loading rate of nitrogen kg/ha/year	130.0	130.0	130.0
A - The irrigation area (hectares)	20.0	20.0	20.0
Q - Average effluent flow rate kL/ha/year	3333.3	4905.7	10833.3
Actual amount of effluent irrigated kL/ha/year	2057.0	2057.0	2057.0
Actual Nitrogen applied in effluent (load) kg/ha	24.7	54.5	80.2

The critical loading rate of constituent (L_c) has been calculated from annual nutrient uptake ranges for perennial pasture as per EPA guidelines (EPA 1995). Table 12 outlines the nutrient uptake ranges in comparison to the actual amount of nutrient applied in the irrigated effluent (at the mean nutrient concentration).

Table 12: Crop nutrient uptake and actual nutrient application 2018/19

Crop	Annual Phosphorus uptake range kg/ha NSW EPA 1995	Phosphorus applied in effluent at mean concentration kg/ha	Annual Nitrogen uptake range kg/ha NSW EPA 1995	Nitrogen applied in effluent at mean concentration kg/ha
Perennial Pasture	8 - 16	12.21	65 - 130	54.51

Table 13 shows the recommended irrigation rate based on sustainable nutrient loading in comparison to actual irrigation in 2018/19. The values in Table 13 are in Megalitres per hectare per year.

Table 13: *Recommended effluent application rates (ML/ha)*

Effluent application	Actual application	Perennial Pasture	
		Phosphorus	Nitrogen
<u>2018/19</u>	<u>2018/19</u>		
Maximum	2.057	5.10	10.83
Average	2.057	2.70	4.91
Minimum	2.057	1.82	3.33

5.0 Conclusion & Recommendation

From the mass balance calculations, it can be seen that the amount of nitrogen and phosphorus applied in the effluent is theoretically lower than what the plants can effectively utilise. This shows that at average rates, plants should be able to assimilate the applied nutrients as shown in Table 9. The amount of effluent applied is within the recommended application rate range shown in Table 13 for phosphorus and below the recommended application rate range for nitrogen.

6.0 References

ANZECC 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy*, Australia & New Zealand Environment & Conservation Council, Sydney.

Bureau of Meteorology 2019, Climate Data Online, <http://www.bom.gov.au/climate/data/>, Data accessed 1 May 2019.

Charman, PEV & Murphy, BW 1991, *Soils Their Properties and Management*, Oxford University Press, Australia

DEC 2004, *Environmental guidelines, Use of Effluent by Irrigation*, Department of Environment and Conservation (NSW), Sydney

DIPNR 2003, *Minimum Construction Requirements for Water Bores in Australia*, 2nd edn, Department of Infrastructure, Planning & Natural Resources, Sydney.

Glendinning JS (1999), *Australian Soil Fertility Manual*, CSIRO Publishing, Collingwood, Victoria

NRMCC/EPHC 2005, *National Guidelines for Water Recycling - Managing Health and Environmental Risks*, Environmental Protection and Heritage Council and Natural Resource Management Ministerial Council

NHMRC/ARMCA&NZ 1996, *Australian Drinking Water Guidelines*, publ. National Health & Medical Research Council and the Agriculture & Resource Management Council of Australia and New Zealand

NSW EPA 1997, *Environmental Guidelines: Use & Disposal of Biosolids Products*, NSW Environment Protection Authority, Sydney, NSW

Reuter DJ & Robinson JB 1997, *Plant Analysis an Interpretation Manual*, CSIRO Publishing, Collingwood, Victoria

Singer, MJ & Munns, DN 1996, *Soils an Introduction*, 3rd edition, Prentice Hall, New Jersey, USA

7.0 Disclaimer

The information contained in this report has been extracted from field and laboratory sources believed to be reliable and accurate. DM McMahon Pty Ltd assume any responsibility for the misinterpretation of information supplied in this report. The accuracy and reliability of recommendations identified in this report need to be evaluated with due care according to individual circumstances. It should be noted that the recommendations and findings in this report are based solely upon the said site location and the ground level conditions at the time of testing. The results of the said investigations undertaken are an overall representation of the conditions encountered. The properties of the soil within the location may change due to variations in ground conditions outside of the tested area. The author has no control or liability over site variability that may warrant further investigation that may lead to significant design changes.

8.0 Notice of Copyright

The information contained in this report must not be copied, reproduced or used for any purpose other than a purpose approved by DM McMahon Pty Ltd, except as permitted under the Copyright Act 1968. Information cannot be stored or recorded electronically in any form without such permission. © DM McMahon Pty Ltd

9.0 Attachments

Attachments	Details
A. Certificates of Analysis	16 pages
B. Laboratory Chain of Custodies	8 pages



DOCUMENT ATTACHMENTS

REPORT 2019

DM McMahon Pty Ltd
6 Jones Street, (PO Box 6118)
Wagga Wagga NSW 2650

t (02) 6931 0510
www.dmmcmahon.com.au



Attachment A : *Certificates of Analysis*

DM McMahon Pty Ltd

Wednesday, October 31, 2018

PO Box 6118 6 Jones Street

Wagga Wagga NSW 2650

Attention: David McMahon



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1810-0081

Page 1 of 2

For all enquiries related to this report please quote document number: 1810-0081

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Water	Z. Bradley	16-October-2018

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
18Oct-0279	Point 1 (Irrigation) 15.10.18 2.45pm	Biochemical Oxygen Demand	8 mg/L	APHA 5210 B/4500-O G	2
		Calcium (dissolved)	34.4 mg/L	APHA 3030 B/3120 B	0.03
		Faecal coliforms	45 cfu/100mL	* AS/NZS 4276.7:2007	
		Conductivity	797 µS/cm	APHA 2510 B	1
		Magnesium (dissolved)	11.8 mg/L	APHA 3030 B/3120 B	0.02
		Nitrogen, total	39 mg/L	APHA 4500-Norg B + 4110 B	2
		Nitrate/Nitrite as N	4.3 mg/L	LTM-W-014	0.1
		Oil & Grease	3 mg/L	APHA 5520 D	1
		Phosphorus, Total	7.16 mg/L	APHA 4500-P B5/4500-P E	0.01
		pH	7.8 pH units	APHA 4500-H+ B	
		Sodium Adsorption Ratio	3 Ratio	LTM-W-039	
		Sodium (dissolved)	70.0 mg/L	APHA 3030 B/3120 B	0.05
		Total Kjeldahl Nitrogen	35 mg/L	APHA 4500-Norg B	2
		Total Suspended Solids	7 mg/L	APHA 2540 D	2

Note:

* NATA Accreditation does not cover the performance of this service.

DM McMahon Pty Ltd

Wednesday, October 31, 2018

PO Box 6118 6 Jones Street

Wagga Wagga NSW 2650

Attention: David McMahon



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

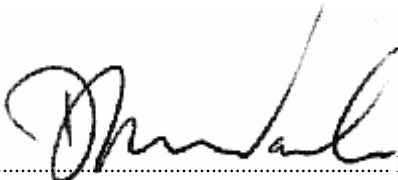
Report Number: 1810-0081

Page 2 of 2

For all enquiries related to this report please quote document number: 1810-0081

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Water	Z. Bradley	16-October-2018

<u>EAL ID</u>	<u>Client ID.</u>	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
	Date/Time sample taken				

Signed  David Wade, Laboratory Manager.

*All samples analysed as received.
All soil results are reported on a dry basis.
The EAL takes no responsibility for the end use of results within this report.
This report shall not be reproduced except in full.
This report replaces any previously issued report*

DM McMahon Pty Ltd

Thursday, January 10, 2019

PO Box 6118 6 Jones Street

Wagga Wagga NSW 2650

Attention: David McMahon



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1812-0068

Page 1 of 2

For all enquiries related to this report please quote document number: 1812-0068

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Water	Z Bradley	14-December-2018

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
18Dec-0229	GSC Point 1 Irrigation 14.12.18 12.00pm	Biochemical Oxygen Demand	25 mg/L	APHA 5210 B/4500-O G	2
		Calcium (dissolved)	24.7 mg/L	APHA 3030 B/3120 B	0.03
		Faecal coliforms	6160 cfu/100mL	* AS/NZS 4276.7:2007	
		Conductivity	585 µS/cm	APHA 2510 B	1
		Magnesium (dissolved)	8.35 mg/L	APHA 3030 B/3120 B	0.02
		Nitrogen, total	32 mg/L	APHA 4500-Norg B + 4110 B	2
		Nitrate/Nitrite as N	5.2 mg/L	LTM-W-014	0.1
		Oil & Grease	3 mg/L	APHA 5520 D	1
		Phosphorus, Total	8.77 mg/L	APHA 4500-P B5/4500-P E	0.05
		pH	8.4 pH units	APHA 4500-H+ B	
		Sodium Adsorption Ratio	3 Ratio	LTM-W-039	
		Sodium (dissolved)	66.1 mg/L	APHA 3030 B/3120 B	0.05
		Total Kjeldahl Nitrogen	27 mg/L	APHA 4500-Norg B	2
		Total Suspended Solids	73 mg/L	APHA 2540 D	2

Note:

* NATA Accreditation does not cover the performance of this service.

DM McMahon Pty Ltd

Thursday, January 10, 2019

PO Box 6118 6 Jones Street

Wagga Wagga NSW 2650

Attention: David McMahon



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

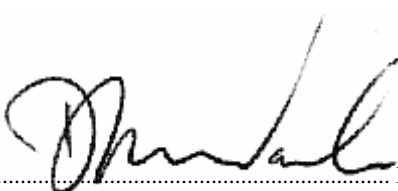
Report Number: 1812-0068

Page 2 of 2

For all enquiries related to this report please quote document number: 1812-0068

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Water	Z Bradley	14-December-2018

<u>EAL ID</u>	<u>Client ID.</u>	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
	Date/Time sample taken				

Signed  David Wade, Laboratory Manager.

All samples analysed as received.
All soil results are reported on a dry basis.
The EAL takes no responsibility for the end use of results within this report.
This report shall not be reproduced except in full.
This report replaces any previously issued report

DM McMahon Pty Ltd

Tuesday, February 26, 2019

PO Box 6118 6 Jones Street

Wagga Wagga NSW 2650

Attention: David McMahon



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number:1902-0063

Page 1 of 3

For all enquiries related to this report please quote document number: 1902-0063

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Water	Z Bradley	13-February-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
19Feb-0171	GSC Point 1 Irrigation 13.02.19 12.00pm	Biochemical Oxygen Demand	23 mg/L	APHA 5210 B/4500-O G	2
		Calcium (dissolved)	14.6 mg/L	APHA 3030 B/3120 B	0.03
		Faecal coliforms	50 cfu/100mL	* AS/NZS 4276.7:2007	
		Conductivity	493 µS/cm	APHA 2510 B	1
		Magnesium (dissolved)	5.63 mg/L	APHA 3030 B/3120 B	0.02
		Nitrogen, total	12 mg/L	APHA 4500-Norg B + 4110 B	2
		Nitrate/Nitrite as N	4.1 mg/L	LTM-W-014	0.1
		Oil & Grease	3 mg/L	APHA 5520 D	1
		Phosphorus, Total	4.67 mg/L	APHA 4500-P B5/4500-P E	0.01
		pH	7.4 pH units	APHA 4500-H+ B	
		Sodium Adsorption Ratio	4 Ratio	LTM-W-039	
		Sodium (dissolved)	69.8 mg/L	APHA 3030 B/3120 B	0.05
		Total Kjeldahl Nitrogen	8 mg/L	APHA 4500-Norg B	2
		Total Suspended Solids	74 mg/L	APHA 2540 D	2
19Feb-0172	Golf Course Pond Inlet 13.02.19 12.00pm	Biochemical Oxygen Demand	29 mg/L	APHA 5210 B/4500-O G	2
		Calcium (dissolved)	17.5 mg/L	APHA 3030 B/3120 B	0.03
		Faecal coliforms	3670 cfu/100mL	* AS/NZS 4276.7:2007	
		Conductivity	1940 µS/cm	APHA 2510 B	1
		Magnesium (dissolved)	6.77 mg/L	APHA 3030 B/3120 B	0.02
		Nitrogen, total	26 mg/L	APHA 4500-Norg B + 4110 B	2
		Nitrate/Nitrite as N	8.1 mg/L	LTM-W-014	0.1

DM McMahon Pty Ltd

Tuesday, February 26, 2019

PO Box 6118 6 Jones Street

Wagga Wagga NSW 2650

Attention: David McMahon



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number:1902-0063

Page 2 of 3

For all enquiries related to this report please quote document number: 1902-0063

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Water	Z Bradley	13-February-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
19Feb-0172	Golf Course Pond Inlet 13.02.19 12.00pm	Oil & Grease	7 mg/L	APHA 5520 D	1
		Phosphorus, Total	6.69 mg/L	APHA 4500-P B5/4500-P E	0.01
		pH	9.4 pH units	APHA 4500-H+ B	
		Sodium Adsorption Ratio	4 Ratio	LTM-W-039	
		Sodium (dissolved)	75.5 mg/L	APHA 3030 B/3120 B	0.05
		Total Kjeldahl Nitrogen	18 mg/L	APHA 4500-Norg B	2
		Total Suspended Solids	128 mg/L	APHA 2540 D	2
19Feb-0173	Maturation Pond Outlet 13.02.19 12.00pm	Biochemical Oxygen Demand	21 mg/L	APHA 5210 B/4500-O G	2
		Calcium (dissolved)	16.4 mg/L	APHA 3030 B/3120 B	0.03
		Faecal coliforms	6560 cfu/100mL	* AS/NZS 4276.7:2007	
		Conductivity	546 µS/cm	APHA 2510 B	1
		Magnesium (dissolved)	6.40 mg/L	APHA 3030 B/3120 B	0.02
		Nitrogen, total	25 mg/L	APHA 4500-Norg B + 4110 B	2
		Nitrate/Nitrite as N	7.2 mg/L	LTM-W-014	0.1
		Oil & Grease	6 mg/L	APHA 5520 D	1
		Phosphorus, Total	6.06 mg/L	APHA 4500-P B5/4500-P E	0.01
		pH	9.6 pH units	APHA 4500-H+ B	
		Sodium Adsorption Ratio	4 Ratio	LTM-W-039	
		Sodium (dissolved)	71.3 mg/L	APHA 3030 B/3120 B	0.05
		Total Kjeldahl Nitrogen	18 mg/L	APHA 4500-Norg B	2
		Total Suspended Solids	152 mg/L	APHA 2540 D	2

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Tuesday, February 26, 2019



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1902-0063

Page 3 of 3

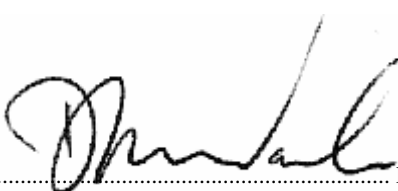
For all enquiries related to this report please quote document number: 1902-0063

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Water	Z Bradley	13-February-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
---------------	---	-------------	-----------------------	-------------------------	---------------------------

Note:

* NATA Accreditation does not cover the performance of this service.

Signed  David Wade, Laboratory Manager.

All samples analysed as received.
All soil results are reported on a dry basis.
The EAL takes no responsibility for the end use of results within this report.
This report shall not be reproduced except in full.
This report replaces any previously issued report

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Monday, April 29, 2019



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1904-0076

Page 1 of 2

For all enquiries related to this report please quote document number: 1904-0076

<u>Facility:</u>	<u>Order #</u>	
<u>Sample Type</u>	<u>Collected By</u>	<u>Date Received</u>
Water	J Halse	11-April-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
19Apr-0270	GSC Piezo 2 11.04.19	Biochemical Oxygen Demand	10 mg/L	APHA 5210 B/4500-O G	2
		Calcium (dissolved)	45.7 mg/L	APHA 3030 B/3120 B	0.03
		Conductivity	718 µS/cm	APHA 2510 B	1
		Magnesium (dissolved)	44.4 mg/L	APHA 3030 B/3120 B	0.02
		Nitrogen, total	22 mg/L	APHA 4500-Norg B + 4110 B	2
		Nitrate/Nitrite as N	0.5 mg/L	LTM-W-014	0.1
		Oil & Grease	3 mg/L	APHA 5520 D	1
		Phosphorus, Total	8.23 mg/L	APHA 4500-P B5/4500-P E	0.01
		pH	7.1 pH units	APHA 4500-H+ B	
		Sodium Adsorption Ratio	2 Ratio	LTM-W-039	
		Sodium (dissolved)	80.1 mg/L	APHA 3030 B/3120 B	0.05
		Total Kjeldahl Nitrogen	22 mg/L	APHA 4500-Norg B	2
		Total Suspended Solids	34300 mg/L	APHA 2540 D	2

Note:

* NATA Accreditation does not cover the performance of this service.

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Monday, April 29, 2019



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

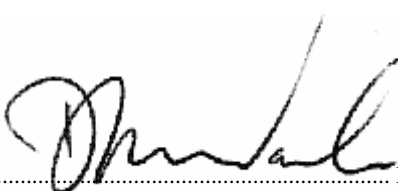
Report Number: 1904-0076

Page 2 of 2

For all enquiries related to this report please quote document number: 1904-0076

<u>Facility:</u>	<u>Order #</u>	
<u>Sample Type</u>	<u>Collected By</u>	<u>Date Received</u>
Water	J Halse	11-April-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
---------------	---	-------------	-----------------------	-------------------------	---------------------------

Signed  David Wade, Laboratory Manager.

*All samples analysed as received.
All soil results are reported on a dry basis.
The EAL takes no responsibility for the end use of results within this report.
This report shall not be reproduced except in full.
This report replaces any previously issued report*

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Monday, April 29, 2019



NATA Accredited Laboratory
Number: 9597
Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1904-0077

Page 1 of 3

For all enquiries related to this report please quote document number: 1904-0077

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Water	J Halse	11-April-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
19Apr-0271	GSC Point 1 Irrigation 11.04.19 11.27am	Biochemical Oxygen Demand	9 mg/L	APHA 5210 B/4500-O G	2
		Calcium (dissolved)	21.4 mg/L	APHA 3030 B/3120 B	0.03
		Faecal coliforms	734 cfu/100mL	* AS/NZS 4276.7:2007	
		Conductivity	533 µS/cm	APHA 2510 B	1
		Magnesium (dissolved)	9.40 mg/L	APHA 3030 B/3120 B	0.02
		Nitrogen, total	23 mg/L	APHA 4500-Norg B + 4110 B	2
		Nitrate/Nitrite as N	11.1 mg/L	LTM-W-014	0.5
		Oil & Grease	1 mg/L	APHA 5520 D	1
		Phosphorus, Total	3.14 mg/L	APHA 4500-P B5/4500-P E	0.01
		pH	7.5 pH units	APHA 4500-H+ B	
		Sodium Adsorption Ratio	4 Ratio	LTM-W-039	
		Sodium (dissolved)	83.0 mg/L	APHA 3030 B/3120 B	0.05
		Total Kjeldahl Nitrogen	12 mg/L	APHA 4500-Norg B	2
		Total Suspended Solids	33 mg/L	APHA 2540 D	2

19Apr-0272	Golf Course Pond Inlet 11.04.19 11.27am	Biochemical Oxygen Demand	30 mg/L	APHA 5210 B/4500-O G	2
		Calcium (dissolved)	23.2 mg/L	APHA 3030 B/3120 B	0.03
		Faecal coliforms	36000 cfu/100mL	* AS/NZS 4276.7:2007	
		Conductivity	600 µS/cm	APHA 2510 B	1
		Magnesium (dissolved)	9.20 mg/L	APHA 3030 B/3120 B	0.02
		Nitrogen, total	28 mg/L	APHA 4500-Norg B + 4110 B	2
		Nitrate/Nitrite as N	16.7 mg/L	LTM-W-014	0.5

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Monday, April 29, 2019



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1904-0077

Page 2 of 3

For all enquiries related to this report please quote document number: 1904-0077

<u>Facility:</u>	<u>Order #</u>	
<u>Sample Type</u>	<u>Collected By</u>	<u>Date Received</u>
Water	J Halse	11-April-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
19Apr-0272	Golf Course Pond Inlet 11.04.19 11.27am	Oil & Grease	2 mg/L	APHA 5520 D	1
		Phosphorus, Total	4.45 mg/L	APHA 4500-P B5/4500-P E	0.01
		pH	8.5 pH units	APHA 4500-H+ B	
		Sodium Adsorption Ratio	4 Ratio	LTM-W-039	
		Sodium (dissolved)	83.9 mg/L	APHA 3030 B/3120 B	0.05
		Total Kjeldahl Nitrogen	11 mg/L	APHA 4500-Norg B	2
		Total Suspended Solids	86 mg/L	APHA 2540 D	2
19Apr-0273	Maturation Pond Outlet 11.04.19 11.27am	Biochemical Oxygen Demand	20 mg/L	APHA 5210 B/4500-O G	2
		Calcium (dissolved)	24.0 mg/L	APHA 3030 B/3120 B	0.03
		Faecal coliforms	41000 cfu/100mL	* AS/NZS 4276.7:2007	
		Conductivity	609 µS/cm	APHA 2510 B	1
		Magnesium (dissolved)	9.46 mg/L	APHA 3030 B/3120 B	0.02
		Nitrogen, total	28 mg/L	APHA 4500-Norg B + 4110 B	2
		Nitrate/Nitrite as N	16.1 mg/L	LTM-W-014	0.5
		Oil & Grease	3 mg/L	APHA 5520 D	1
		Phosphorus, Total	5.11 mg/L	APHA 4500-P B5/4500-P E	0.01
		pH	8.8 pH units	APHA 4500-H+ B	
		Sodium Adsorption Ratio	4 Ratio	LTM-W-039	
		Sodium (dissolved)	87.9 mg/L	APHA 3030 B/3120 B	0.05
		Total Kjeldahl Nitrogen	12 mg/L	APHA 4500-Norg B	2
		Total Suspended Solids	94 mg/L	APHA 2540 D	2

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Monday, April 29, 2019



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1904-0077

Page 3 of 3

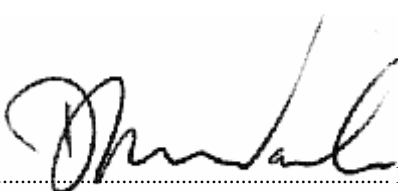
For all enquiries related to this report please quote document number: 1904-0077

<u>Facility:</u>	<u>Order #</u>	
<u>Sample Type</u>	<u>Collected By</u>	<u>Date Received</u>
Water	J Halse	11-April-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
---------------	---	-------------	-----------------------	-------------------------	---------------------------

Note:

* NATA Accreditation does not cover the performance of this service.

Signed  David Wade, Laboratory Manager.

All samples analysed as received.
All soil results are reported on a dry basis.
The EAL takes no responsibility for the end use of results within this report.
This report shall not be reproduced except in full.
This report replaces any previously issued report

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Monday, May 6, 2019



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1904-0079

Page 1 of 4

For all enquiries related to this report please quote document number: 1904-0079

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Soil	Client	11-April-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
19Apr-0278	Fairway 5 0-10 10.04.19 12.00	Phosphorus, Total	474 mg/kg	LTM-S-015	2
		Total Kjeldahl Nitrogen	2940 mg/kg	LTM-S-011	2
19Apr-0279	Fairway 8 0-10 10.04.19 12.00	Phosphorus, Total	701 mg/kg	LTM-S-015	2
		Total Kjeldahl Nitrogen	3190 mg/kg	LTM-S-011	2
19Apr-0280	Control 0-10 10.04.19 12.00	Phosphorus, Total	438 mg/kg	LTM-S-015	2
		Total Kjeldahl Nitrogen	2350 mg/kg	LTM-S-011	2
19Apr-0281	Fairway 5 10-30 10.04.19 12.00	Conductivity (1:5 soil/water)	56 µS/cm	LTM-S-003	1
		Nitrate as N	12 mg/kg	LTM-S-007	1
		Phosphorus, Total	325 mg/kg	LTM-S-015	2
		pH (1:5 soil/water)	6.6 pH units	LTM-S-004	
19Apr-0282	Fairway 5 30-60 10.04.19 12.00	Conductivity (1:5 soil/water)	39 µS/cm	LTM-S-003	1
		Nitrate as N	6 mg/kg	LTM-S-007	1
		Phosphorus, Total	392 mg/kg	LTM-S-015	2
		pH (1:5 soil/water)	6.8 pH units	LTM-S-004	
19Apr-0283	Fairway 5 60-100 10.04.19 12.00	Conductivity (1:5 soil/water)	30 µS/cm	LTM-S-003	1

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Monday, May 6, 2019



NATA Accredited Laboratory
Number: 9597
Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1904-0079

Page 2 of 4

For all enquiries related to this report please quote document number: 1904-0079

<u>Facility:</u>	<u>Order #</u>	<u>Sample Type</u>	<u>Collected By</u>	<u>Date Received</u>
Soil	Client			11-April-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
19Apr-0283	Fairway 5 60-100 10.04.19 12.00	Nitrate as N	3 mg/kg	LTM-S-007	1
		Phosphorus, Total	465 mg/kg	LTM-S-015	2
		pH (1:5 soil/water)	7.1 pH units	LTM-S-004	
19Apr-0284	Fairway 8 10-30 10.04.19 12.30	Conductivity (1:5 soil/water)	53 µS/cm	LTM-S-003	1
		Nitrate as N	<1 mg/kg	LTM-S-007	1
		Phosphorus, Total	472 mg/kg	LTM-S-015	2
		pH (1:5 soil/water)	6.9 pH units	LTM-S-004	
19Apr-0285	Fairway 8 30-60 10.04.19 12.30	Conductivity (1:5 soil/water)	59 µS/cm	LTM-S-003	1
		Nitrate as N	<1 mg/kg	LTM-S-007	1
		Phosphorus, Total	512 mg/kg	LTM-S-015	2
		pH (1:5 soil/water)	6.8 pH units	LTM-S-004	
19Apr-0286	Fairway 8 60-100 10.04.19 12.30	Conductivity (1:5 soil/water)	59 µS/cm	LTM-S-003	1
		Nitrate as N	<1 mg/kg	LTM-S-007	1
		Phosphorus, Total	489 mg/kg	LTM-S-015	2
		pH (1:5 soil/water)	6.8 pH units	LTM-S-004	
19Apr-0287	Control 10-30 10.04.19 1.00	Conductivity (1:5 soil/water)	35 µS/cm	LTM-S-003	1
		Nitrate as N	5 mg/kg	LTM-S-007	1

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Monday, May 6, 2019



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

Report Number: 1904-0079

Page 3 of 4

For all enquiries related to this report please quote document number: 1904-0079

<u>Facility:</u>	<u>Order #</u>	<u>Date Received</u>
<u>Sample Type</u>	<u>Collected By</u>	
Soil	Client	11-April-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
19Apr-0287	Control 10-30 10.04.19 1.00	Phosphorus, Total	351 mg/kg	LTM-S-015	2
		pH (1:5 soil/water)	6.9 pH units	LTM-S-004	
19Apr-0288	Control 30-60 10.04.19 1.00	Conductivity (1:5 soil/water)	26 µS/cm	LTM-S-003	1
		Nitrate as N	2 mg/kg	LTM-S-007	1
		Phosphorus, Total	332 mg/kg	LTM-S-015	2
		pH (1:5 soil/water)	7.2 pH units	LTM-S-004	
19Apr-0289	Control 60-100 10.04.19 1.00	Conductivity (1:5 soil/water)	24 µS/cm	LTM-S-003	1
		Nitrate as N	1 mg/kg	LTM-S-007	1
		Phosphorus, Total	346 mg/kg	LTM-S-015	2
		pH (1:5 soil/water)	7.3 pH units	LTM-S-004	

Note:

* NATA Accreditation does not cover the performance of this service.

DM McMahon Pty Ltd
PO Box 6118 6 Jones Street
Wagga Wagga NSW 2650
Attention: David McMahon

Monday, May 6, 2019



NATA Accredited Laboratory
Number: 9597

Accredited for compliance with
ISO/IEC 17025 - Testing

LABORATORY ANALYSIS REPORT

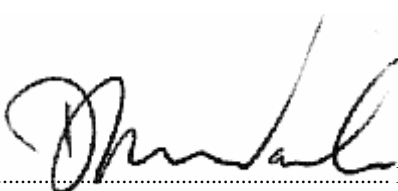
Report Number: 1904-0079

Page 4 of 4

For all enquiries related to this report please quote document number: 1904-0079

<u>Facility:</u>	<u>Order #</u>	
<u>Sample Type</u>	<u>Collected By</u>	<u>Date Received</u>
Soil	Client	11-April-2019

<u>EAL ID</u>	<u>Client ID.</u> Date/Time sample taken	<u>Test</u>	<u>Result (units)</u>	<u>Method Reference</u>	<u>Limit of Reporting</u>
---------------	---	-------------	-----------------------	-------------------------	---------------------------

Signed  David Wade, Laboratory Manager.

*All samples analysed as received.
All soil results are reported on a dry basis.
The EAL takes no responsibility for the end use of results within this report.
This report shall not be reproduced except in full.
This report replaces any previously issued report*



Nutrient Advantage®

Nutrient Advantage Advice®

Nutrient Report

DM McMahon Pty Ltd
 PO BOX 6118
 WAGGA WAGGA
 NSW 2650

Report Print Date: 23/04/2019
Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5927 BIDGE BANK

Grower Name : D M MCMAHON PTY LTD
Sample No: 022019555
Paddock Name: CONTROL
Sample Name: CONTROL
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E13
Sample Type: Soil
Sampling Date: 18/04/2019

Analyte / Assay	Units	Value
Soil Colour		Brown
Soil Texture		Clay Loam
pH (1:5 Water)		6.3
pH (1:5 CaCl2)		5.5
Electrical Conductivity (1:5 water)	dS/m	0.09
Electrical Conductivity (Sat. Ext.)	dS/m	0.7
Chloride	mg/kg	11
Organic Carbon (W&B)	%	2.5
Nitrate Nitrogen	mg/kg	16
Ammonium Nitrogen	mg/kg	3
Phosphorus (Colwell)	mg/kg	48
Phosphorus Buffer Index		55
Sulphur (KCl40)	mg/kg	6
Cation Exch. Cap. (CEC)	cmol(+)/kg	12.3
Calcium (Amm-acet.)	cmol(+)/kg	8.9
Magnesium (Amm-acet.)	cmol(+)/kg	2.5
Sodium (Amm-acet.)	cmol(+)/kg	0.14
Potassium (Amm-acet.)	cmol(+)/kg	0.76
Available Potassium	mg/kg	300
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	73.0

Analyses conducted by **Nutrient Advantage Laboratory Services**



NATA Accreditation No: 11958

Certificate of Analysis is available upon request.

8 South Road, Werribee VIC 3030

Tel: 1800 803 453

Email: lab.feedback@incitecpivot.com.au





Nutrient Advantage[®]

Nutrient Advantage Advice[®]

Nutrient Report

Grower Name : D M MCMAHON PTY LTD
Sample No: 022019555
Paddock Name: CONTROL
Sample Name: CONTROL
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E13
Sample Type: Soil
Sampling Date: 18/04/2019

Analyte / Assay	Units	Value
Magnesium % of Cations	%	20.0
Sodium % of Cations (ESP)	%	1.10
Potassium % of Cations	%	6.20
Calcium/Magnesium Ratio		3.6
Zinc (DTPA)	mg/kg	4.40
Copper (DTPA)	mg/kg	9.00
Iron (DTPA)	mg/kg	120.0
Manganese (DTPA)	mg/kg	29.0
Boron (Hot CaCl ₂)	mg/kg	0.5

The results reported pertain only to the sample submitted.

Analyses performed on soil dried at 40 degrees Celsius and ground to <2mm (excluding moisture assay)

* One or more components of this test are below their detection limit. The value used is indicative only.

Disclaimer: Laboratory analyses and fertiliser recommendations are made in good faith, based on the best technical information available as at the date of this report. Incitec Pivot Limited, its officers, employees, consultants, Agents and Dealers do not accept any liability whatsoever arising from or in connection with the analytical results, interpretations and recommendations provided, and the client takes the analytical results, interpretations and recommendations on these terms. In respect of liability which cannot be excluded by law, Incitec Pivot's liability is restricted to the re-supply of the laboratory analysis or the cost of having the analysis re-supplied.





Nutrient Advantage®

Nutrient Advantage Advice®

Nutrient Report

DM McMahon Pty Ltd
 PO BOX 6118
 WAGGA WAGGA
 NSW 2650

Report Print Date: 23/04/2019
Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5927 BIDGE BANK

Grower Name : D M MCMAHON PTY LTD
Sample No: 022019556
Paddock Name: FAIRWAY 8
Sample Name: FAIRWAY 8
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E13
Sample Type: Soil
Sampling Date: 18/04/2019

Analyte / Assay	Units	Value
Soil Colour		Brown
Soil Texture		Clay Loam
pH (1:5 Water)		6.3
pH (1:5 CaCl2)		5.7
Electrical Conductivity (1:5 water)	dS/m	0.19
Electrical Conductivity (Sat. Ext.)	dS/m	1.5
Chloride	mg/kg	57
Organic Carbon (W&B)	%	3.4
Nitrate Nitrogen	mg/kg	18
Ammonium Nitrogen	mg/kg	5
Phosphorus (Colwell)	mg/kg	190
Phosphorus Buffer Index		88
Sulphur (KCl40)	mg/kg	22
Cation Exch. Cap. (CEC)	cmol(+)/kg	17.0
Calcium (Amm-acet.)	cmol(+)/kg	9.4
Magnesium (Amm-acet.)	cmol(+)/kg	5.7
Sodium (Amm-acet.)	cmol(+)/kg	0.45
Potassium (Amm-acet.)	cmol(+)/kg	1.40
Available Potassium	mg/kg	560
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	55.0



Analyses conducted by **Nutrient Advantage Laboratory Services**

NATA Accreditation No: 11958

Certificate of Analysis is available upon request.

8 South Road, Werribee VIC 3030

Tel: 1800 803 453

Email: lab.feedback@incitecpivot.com.au





Nutrient Advantage[®]

Nutrient Advantage Advice[®]

Nutrient Report

Grower Name : D M MCMAHON PTY LTD
Sample No: 022019556
Paddock Name: FAIRWAY 8
Sample Name: FAIRWAY 8
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E13
Sample Type: Soil
Sampling Date: 18/04/2019

Analyte / Assay	Units	Value
Magnesium % of Cations	%	34.0
Sodium % of Cations (ESP)	%	2.60
Potassium % of Cations	%	8.40
Calcium/Magnesium Ratio		1.6
Zinc (DTPA)	mg/kg	8.20
Copper (DTPA)	mg/kg	2.10
Iron (DTPA)	mg/kg	270.0
Manganese (DTPA)	mg/kg	23.0
Boron (Hot CaCl ₂)	mg/kg	0.8

The results reported pertain only to the sample submitted.

Analyses performed on soil dried at 40 degrees Celsius and ground to <2mm (excluding moisture assay)

* One or more components of this test are below their detection limit. The value used is indicative only.

Disclaimer: Laboratory analyses and fertiliser recommendations are made in good faith, based on the best technical information available as at the date of this report. Incitec Pivot Limited, its officers, employees, consultants, Agents and Dealers do not accept any liability whatsoever arising from or in connection with the analytical results, interpretations and recommendations provided, and the client takes the analytical results, interpretations and recommendations on these terms. In respect of liability which cannot be excluded by law, Incitec Pivot's liability is restricted to the re-supply of the laboratory analysis or the cost of having the analysis re-supplied.





Nutrient Advantage®

Nutrient Advantage Advice®

Nutrient Report

DM McMahon Pty Ltd
 PO BOX 6118
 WAGGA WAGGA
 NSW 2650

Report Print Date: 23/04/2019
Agent/Dealer:
Advisor/Contact: D M MCMAHON PTY LTD
Phone: 02 6931 0510
Purchase Order No: 5927 BIDGE BANK

Grower Name : D M MCMAHON PTY LTD
Sample No: 022019557
Paddock Name: FAIRWAY 5
Sample Name: FAIRWAY 5
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E13
Sample Type: Soil
Sampling Date: 18/04/2019

Analyte / Assay	Units	Value
Soil Colour		Brown
Soil Texture		Clay Loam
pH (1:5 Water)		5.8
pH (1:5 CaCl ₂)		5.2
Electrical Conductivity (1:5 water)	dS/m	0.20
Electrical Conductivity (Sat. Ext.)	dS/m	1.6
Chloride	mg/kg	42
Organic Carbon (W&B)	%	2.7
Nitrate Nitrogen	mg/kg	70
Ammonium Nitrogen	mg/kg	3
Phosphorus (Colwell)	mg/kg	65
Phosphorus Buffer Index		48
Sulphur (KCl40)	mg/kg	14
Cation Exch. Cap. (CEC)	cmol(+)/kg	13.3
Calcium (Amm-acet.)	cmol(+)/kg	9.1
Magnesium (Amm-acet.)	cmol(+)/kg	3.3
Sodium (Amm-acet.)	cmol(+)/kg	0.09
Potassium (Amm-acet.)	cmol(+)/kg	0.78
Available Potassium	mg/kg	310
Aluminium (KCl)	cmol(+)/kg	<0.1
Aluminium % of Cations	%	<1.0
Calcium % of Cations	%	68.0



Analyses conducted by **Nutrient Advantage Laboratory Services**

NATA Accreditation No: 11958

Certificate of Analysis is available upon request.

8 South Road, Werribee VIC 3030

Tel: 1800 803 453

Email: lab.feedback@incitecpivot.com.au





Nutrient Advantage[®]

Nutrient Advantage Advice[®]

Nutrient Report

Grower Name : D M MCMAHON PTY LTD
Sample No: 022019557
Paddock Name: FAIRWAY 5
Sample Name: FAIRWAY 5
Sample Depth (cm): 0 To 10

Nearest Town: WAGGA NORTH
Test Code: E13
Sample Type: Soil
Sampling Date: 18/04/2019

Analyte / Assay	Units	Value
Magnesium % of Cations	%	25.0
Sodium % of Cations (ESP)	%	0.65
Potassium % of Cations	%	5.90
Calcium/Magnesium Ratio		2.8
Zinc (DTPA)	mg/kg	5.00
Copper (DTPA)	mg/kg	1.40
Iron (DTPA)	mg/kg	190.0
Manganese (DTPA)	mg/kg	29.0
Boron (Hot CaCl ₂)	mg/kg	0.7

The results reported pertain only to the sample submitted.

Analyses performed on soil dried at 40 degrees Celsius and ground to <2mm (excluding moisture assay)

* One or more components of this test are below their detection limit. The value used is indicative only.

Disclaimer: Laboratory analyses and fertiliser recommendations are made in good faith, based on the best technical information available as at the date of this report. Incitec Pivot Limited, its officers, employees, consultants, Agents and Dealers do not accept any liability whatsoever arising from or in connection with the analytical results, interpretations and recommendations provided, and the client takes the analytical results, interpretations and recommendations on these terms. In respect of liability which cannot be excluded by law, Incitec Pivot's liability is restricted to the re-supply of the laboratory analysis or the cost of having the analysis re-supplied.





Attachment B : *Laboratory Chain of Custodies*

DM McMahon Pty Ltd
 PO Box 6118, Wagga Wagga, NSW 2650
 Tel: 0269 310 510 Fax: 0269 310 511
CHAIN OF CUSTODY - LABORATORY WORK REQUEST

BIDGEE BANKS GOLF COURSE - GUNDAGAI SHIRE COUNCIL

Safety: Note presence of hydrochloric acid preservative in glass jars for Oil & Grease

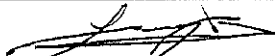
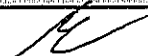
EAL Batch ID	EAL Sample ID	CLIENT ID	DATE SAMPLED	TIME SAMPLED	SAMPLED BY	SAMPLE TYPE		TYPE & NUMBER OF CONTAINERS		
						Grab	Composite	Plastic (1500mL)	Glass (500mL)	Sterile
		Point 1 (Irrigation)	15.10.18	14.45	ZB	✓		1	1	1
		Piezo 1								
		Piezo 2								

Observations:

Analytes:

Point 1 (Irrigation)		Required
Piezo 1 & 2	Quarterly - BOD, Electrical Conductivity, Nitrogen (Total), Oil & Grease, Phosphorus (Total), SAR, *Faecal Coliforms, pH, TSS	
	* Piezo 1 & 2 - do not require Faecal Coliforms	

Please note that samples must be analysed in accordance with the 2004 EPA Guidelines Approved Methods for the sampling and analysis of Water Pollutants in NSW.

Chain of Custody:	NAME	SIGNED	DATE & TIME
RELINQUISHED BY:	Zi Bradley		16.10.18
RECEIVED BY:	M. GAZIA		16/10/18

1012-0068

DM McMahon Pty Ltd
 PO Box 6118, Wagga Wagga, NSW 2650
 Tel: 0269 310 510 Fax: 0269 310 511
CHAIN OF CUSTODY - LABORATORY WORK REQUEST

BIDGEE BANKS GOLF COURSE - GUNDAGAI SHIRE COUNCIL

Safety: Note presence of hydrochloric acid preservative in glass jars for Oil & Grease

EAL Batch ID	EAL Sample ID	CLIENT ID	DATE SAMPLED	TIME SAMPLED	SAMPLED BY	SAMPLE TYPE		TYPE & NUMBER OF CONTAINERS		
						Grab	Composite	Plastic (1500mL)	Glass (500mL)	Sterile
		Point 1 (Irrigation)	14/12	12:00	LN	✓		1	1	1
		Piezo 1						1	1	1
		Piezo 2						1	1	1

Observations:
 Very green, some RAM, cheesy smell.

Analytes:

Point 1 (Irrigation)	BOD, Electrical Conductivity, Nitrogen (Total), Oil & Grease, Phosphorus (Total), SAR, *Faecal Coliforms, pH, TSS,	(Required)
Piezo 1 & 2	Quarterly - BOD, Electrical Conductivity, Nitrogen (Total), Oil & Grease, Phosphorus (Total), SAR, *Faecal Coliforms, pH, TSS,	
	* Piezo 1 & 2 - do not require Faecal Coliforms	

Please note that samples must be analysed in accordance with the 2004 EPA Guidelines Approved Methods for the sampling and analysis of Water Pollutants in NSW.

Chain of Custody:

	NAME	SIGNED	DATE & TIME
RELINQUISHED BY:	Zachary Bradley		14/12/18
RECEIVED BY:	D. Wade		14/12/18

1904-0070

DM McMahon Pty Ltd
 PO Box 6118, Wagga Wagga, NSW 2650
 Tel: 0269 310 510 Fax: 0269 310 511
CHAIN OF CUSTODY - LABORATORY WORK REQUEST

BIDGEE BANKS GOLF COURSE - GUNDAGAI SHIRE COUNCIL

Safety: Note presence of hydrochloric acid preservative in glass jars for Oil & Grease

EAL Batch ID	EAL Sample ID	CLIENT ID	DATE SAMPLED	TIME SAMPLED	SAMPLED BY	SAMPLE TYPE		TYPE & NUMBER OF CONTAINERS		
						Grab	Composite	Plastic (1500mL)	Glass (500mL)	Sterile
		Point 1 (Irrigation)								
		Piezo 1								
		Piezo 2				✓		1	1	1

Observations:

Earthy odour, turbid, grey, particulate matter

Analytes:

Point 1 (Irrigation)	BOD, Electrical Conductivity, Nitrogen (Total), Oil & Grease, Phosphorus (Total), SAR, *Faecal Coliforms, pH, TSS,	
Piezo 1 & 2	Quarterly - BOD, Electrical Conductivity, Nitrogen (Total), Oil & Grease, Phosphorus (Total), SAR, *Faecal Coliforms, pH, TSS,	Required
	* Piezo 1 & 2 - do not require Faecal Coliforms	

Please note that samples must be analysed in accordance with the 2004 EPA Guidelines Approved Methods for the sampling and analysis of Water Pollutants in NSW.

Chain of Custody:

	NAME	SIGNED	DATE & TIME
RELINQUISHED BY:	<i>James Halse</i>	<i>JH</i>	<i>11.09.19</i>
RECEIVED BY:	<i>D. L. Mac</i>	<i>[Signature]</i>	<i>11/09/19</i>

DM McMahon Pty Ltd
 120 Fitzmaurice Street, Wagga Wagga NSW 2650
 TEL 0269 310 510 MOB 0427 214453.

EAL NUMBER

SITE
 Gundagai Golf Course

CLIENT ID	DATE SAMPLED	TIME SAMPLED	COMMENTS	Required Analysis
Fairway 5 0-10	10-4-19	12:00		Suite One
Fairway 8 0-10	"	12:30		Suite One
Control 0-10	"	1:00		Suite One
Fairway 5 10-30	10-4-19	12:00		Suite Two
Fairway 5 30-60	"	"		Suite Two
Fairway 5 60-100	"	"		Suite Two
Fairway 8 10-30	"	12:30		Suite Two
Fairway 8 30-60	"	"		Suite Two
Fairway 8 60-100	"	"		Suite Two
Control 10-30	"	1:00		Suite Two
Control 30-60	"	"		Suite Two
Control 60-100	"	"		Suite Two

Sampling Chain of Custody Record			
Sample Location	Sampling Officer	Sample Bottles Required	
Gundagai Golf Course	Zach Bradbey	1 plastic bag	
Sample Type	Testing unit	Weather Conditions	
Soil		fine + sunny	
Coc	Name	Date & Time	Signature
Officer Collecting Sample	Z. Bradbey	10/4/19 3pm	<i>[Signature]</i>
CSU/EAL Officer Receiving Sample	D. LADG	10/4/19	<i>[Signature]</i>

TEST	Units of Measure	Limit of Reporting	NATA Accredited
Suite One			
TKN - N			
Phosphorus (total)			

Suite Two			
pH			
Electrical Conductivity			
Phosphorus (total)			
Nitrate			

8 SENDER TO KEEP 022019556
 5 SENDER TO KEEP 022019557
 Control SENDER TO KEEP 022019555

1904-0019