

16 December 2021

**Attention:** Troy Watkins  
Visy Albury Pty Ltd  
117 RW Henry Drive  
Ettamogah NSW 2640  
Troy.Watkins@Visy.com.au

**BY EMAIL**

Dear Troy

**Re: Soil monitoring in the tree plantations, crops, and pastures irrigated with treated effluent from the Visy Albury Paper Mill**

I refer to the written instructions from yourself to undertake soil monitoring to satisfy the conditions of the NSW EPA Environmental Protection Licence No. 1272 around the effluent application to land from the Visy Albury Pty Ltd Paper Mill. This assessment is for the use only of Visy Albury Pty Ltd and the NSW EPA for regulatory compliance and is not to be relied upon for any other purpose. No responsibility is accepted to any third party who may use or rely on the whole or any part of the content of this report. Please find as follows the results of the monitoring.

**Background**

Effluent from the Paper Mill at Albury has been applied to tree plantations since 1995 and to crops and pastures since 2003. Soil monitoring has historically been conducted by Timberlands Research Pty Ltd with a dataset dating back to 1993. McMahon has taken over the soil monitoring in 2021 with the retirement of Timberlands' principal. Visy's Environmental Protection Licence requires that soil monitoring within these areas be conducted annually to assess the capacity of the soil to effectively utilise the effluent, both the hydraulic and nutrient load.

**Objective and scope**

The objective of this report is to satisfy the conditions of the NSW EPA Environmental Protection Licence No. 1272 around the effluent application to land.

The scope is to conduct soil sampling at predetermined locations, undertake laboratory analysis on the collected samples in line with the required test elements, conduct data trends analysis, and provide a written summary and assessment of the results.

## **Location and description of the project site and its history**

The Mill, tree plantations and crop/pasture areas are located adjacent to the Hume Highway around 12km north of the Albury City centre. The footprint of the Mill is around 60ha within the 1,200ha property with surrounding land use being agricultural, large lot residential and industrial.

The Mill was constructed for newsprint production between 1979 and 1981 with water supplied from the Murray River. The water once used in the Mill is treated and stored in the 60ha storage dam. Excess cooling water is discharged to the Murray River and there is contingency for emergency discharge from the storage dam to the same when the dam level dictates.

Visy purchased the closed Mill in 2019 from Norske Skog and plan to modify it for paper production.

## **Description of the regional and local environment**

The tree plantation and crop/pasture areas lie on south trending undulating low hills and long gently inclined footslopes at an elevation range of around 200-260m. Landform elements include rounded crests and gentle waxing slopes with widely spaced and poorly defined drainages.

Soils consist of deep moderately drained red and yellow podzolic soils on the crests and upper slopes. The footslopes and drainage lines consist of deep poorly drained yellow sodosols. A bleached silty colluvial soil (A2 Horizon) in between the topsoil and clay subsoil is a feature of the footslopes indicating limited drainage.

From the available data groundwater is likely present in a low yielding fractured granite aquifer beneath the site with a gradient assumed to be a muted reflection of the surface topography. Some flow is likely to occur through colluvial soil on footslopes and lower slopes and in drainages in years of above average rainfall.

Albury has a warm temperate climate with cool wet winters and warm dry summers. Rainfall exceeds evaporation on average in the winter months only. The Albury Airport weather station recorded 829.9 mm of rainfall in 2021 at the time of writing of this report, above the mean annual rainfall of 691.1 mm. Mean monthly maximum temperatures were below average in 2021, apart from May and August; and mean monthly minimum temperatures were below average except for the winter months and September.

## **Records of fieldwork and laboratory analysis**

As conditioned in the Environmental Protection Licence, samples are required to be tested at four depths (0-10cm, 20-30cm, 50-60cm, and 80-90cm) within the tree plantations and at three depths (0-10cm, 20-30cm and 50-60cm) within the crops and pastures. Chemical physical testing is conducted on each sample for pH (H<sub>2</sub>O) & CaCl<sub>2</sub>, electrical conductivity, extractable sulphate, exchangeable cations (calcium, magnesium, potassium and sodium, and Emerson aggregate stability). Sampling is conducted at the following locations:

- Tree plantation area: 4 irrigated area sample plots.
- Ettamogah and Maryvale crop/pasture area: 9 irrigated area and 4 control area plots.
- Rosevale crop/pasture area: 3 irrigated area and 1 control area plots.

The tree plantation sample plots consist of 20m transects with samples composited from ten locations from the mound (tree row) and inter-row. The crop/pasture samples plots consist of 30m transects with samples composited from six locations.

During sampling on 22 and 23 November 2021, plantation sites 21 & 28 contained second rotation eucalyptus plantings; and sites 22 & 23 had second rotation pine plantings. Irrigated plots 18 & 26 had rough pasture; plots 2, 4, 6, 24 & 42 were sown to lucerne crops; Maryvale 14 & 16 were sown to barley crops; Maryvale 8 & 10 to oats; and Ettamogah 29 was sown to brassica and lucerne.

A plan of the sample locations can be seen in **Attachment A**.

## Summary of results

*Tree plantation areas* – Results can be seen in **Attachment B & Attachment C**.

- Average pH (1:5 CaCl<sub>2</sub>) ranged from 5.2 to 6.0 in the upper layers (0-10cm, 20-30cm) and between 5.65 and 5.95 in the subsoil layers (50-60cm, 80-90cm). Average pH (1:5 CaCl<sub>2</sub>) declined from the 2020 results in all layers apart from 20-30cm which increased from 5.78 to 6.03 pH (1:5 CaCl<sub>2</sub>).
- Average salinity (EC<sub>se</sub>) ranged from 0.54 to 1.14 dS/m in the upper layers and from 0.77 to 1.87 dS/m in the lower layers. Average salinity declined between 2020 and 2021 in 0-10cm, 50-60cm; however, it increased in 20-30cm, 80-90cm.
- Average exchangeable cations (Ca, Mg, K, Na) generally increased slightly or remained relatively stable from 2020 levels, apart from exchangeable calcium which experienced a mean decline of 16.6% across all sample depths between 2020 and 2021. Ca/Mg ratios consequently declined, ranging from 2.025 to 4.075.
- Average exchangeable sodium percentage (ESP) ranged from 4.6% to 18.0%, with all soil layers experiencing increased levels of ESP between 2020 and 2021. 0-10cm had 4.6% ESP; 20-30cm had 18.0%; 50-60cm had 14.4%; 80-90cm had 17.4%.
- Average extractable sulphur remained relatively consistent with previous years, ranging from 8.25 to 38.5 mg/kg (0-10cm, 20-30cm, 50-60cm). 80-90cm experienced a higher increase from 2020 to 2021 (48.5 to 127.3 mg/kg), however, the result is similar to pre-2020 levels.

*Crops and pasture areas* – Results can be seen in **Attachment C & Attachment D**.

- Average pH (1:5 CaCl<sub>2</sub>) ranged from 6.0 to 6.2 in un-irrigated plots, and between 6.9 and 7.5 in plots irrigated with effluent. Average pH (1:5 CaCl<sub>2</sub>) declined slightly from the 2020 results in irrigated plots but increased in un-irrigated plots.
- Average salinity (EC<sub>se</sub>) ranged from 0.45 to 0.73 dS/m in un-irrigated plots, remaining similar to 2020 levels. In the irrigated plots, average EC<sub>se</sub> slightly increased from 2020 in 20-30cm and 50-60cm and decreased from 0.89 to 0.85 dS/m in 0-10cm.
- Average exchangeable cations (Ca, Mg, K, Na) generally remained consistent with 2020 levels in un-irrigated plots, apart from some decreased results in magnesium (0.56 cmolc/kg, 20-30cm) and potassium (0.50 cmolc/kg, 0-10cm). Effluent irrigated plots generally experienced slight declines in average exchangeable cations, with some increased levels in magnesium (3.3 cmolc/kg, 50-60cm) and sodium (2.3 cmolc/kg, 50-60cm). Ca/Mg ratios remained relatively similar to 2020 except for 20-30cm in un-irrigated plots (7.24).

- Average exchangeable sodium percentage (ESP) was recorded as 2.7% (0-10cm), 6.0% (20-30cm) and 11.9% (50-60cm) in un-irrigated plots, increasing slightly from the 2020 levels. ESP in the irrigated areas was found to be 2.2% (0-10cm), 10.3% (20-30cm) and 25.8% (50-60cm), staying relatively consistent with the levels recorded in 2020.
- Average extractable sulphur in un-irrigated plots was similar to 2020 levels, ranging from 5.2 to 23.2 mg/kg. Levels slightly increased in effluent irrigated plots, ranging from 14.5 to 60.4 mg/kg.

*Soil salinity* – Results can be seen in **Attachment E & Attachment F**.

- Average salinity in the root zones of plantation areas was  $0.9 \pm 0.6$  dS/m. Plantation soil salinity had previously been declining between 2018 (1.4 dS/m) and 2020 (0.8 dS/m) but has increased slightly over the 2020-21 monitoring period to the present level of 0.9 dS/m.
- Average salinity in the root zones of effluent irrigated crops and pasture areas was  $0.99 \pm 0.38$  dS/m. The average soil salinity has increased slightly from  $0.96 \pm 0.23$  dS/m in 2020.
- Average soil salinity in the root zones of un-irrigated crops and pasture areas was  $0.55 \pm 0.28$  dS/m. Soil salinity has declined slightly from  $0.64 \pm 0.40$  dS/m in 2020.
- The coefficient of variation of average soil salinity ranged from 38.3% (irrigated crops & pasture) to 64% (plantation), which is consistent with previous monitoring results.

## Discussion

The soil monitoring demonstrates since irrigation of treated effluent began some increases in pH, salinity, sodicity and sulphate were observed but the longer-term trends indicate these changes are relatively minor. Some minor seasonal variations are noted, these attributable to changes in wastewater quality and the amount of irrigation occurring in 2021 owing to the above average rainfall. The inherent soil characteristics of the poorly drained yellow sodosols on the footslopes provides some challenges to irrigation management as can be seen by higher sodicity and salinity in the subsoils in the crop and pasture areas, however levels of soil salinity remain well below the Load Based Licencing threshold of 4.0 dS/m. In summary, the soil monitoring demonstrates that the effluent is being effectively utilised, both the hydraulic and nutrient load.

If you have any queries about the contents of this letter, please contact the undersigned.

Yours sincerely



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### **Limitations and disclaimer**

DM McMahon Pty Ltd has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Visy Albury Pty Ltd and the NSW EPA and only those third parties who have been authorised by DM McMahon Pty Ltd to rely on this report. The information contained in this report has been extracted from field and laboratory sources believed to be reliable and accurate. DM McMahon Pty Ltd does not 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 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 and groundwater 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.

### **List of attachments**





- A.** Sample locations
- B.** Plantation graphs
- C.** Tabulated results
- D.** Crops and pastures graphs
- E.** ECse tabulated results
- F.** ECse graphs

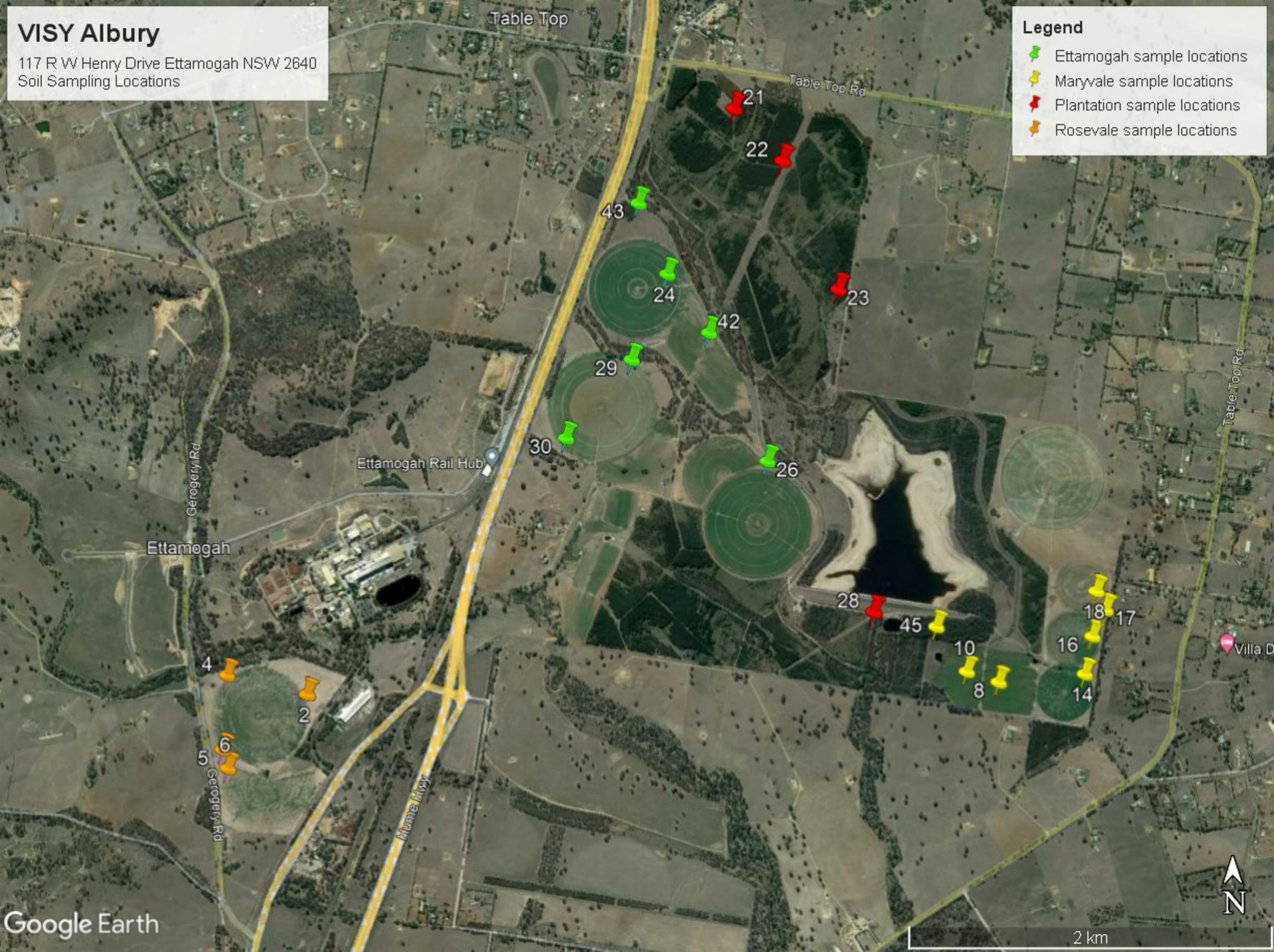


# VISY Albury

117 R W Henry Drive Ettamogah NSW 2640  
Soil Sampling Locations

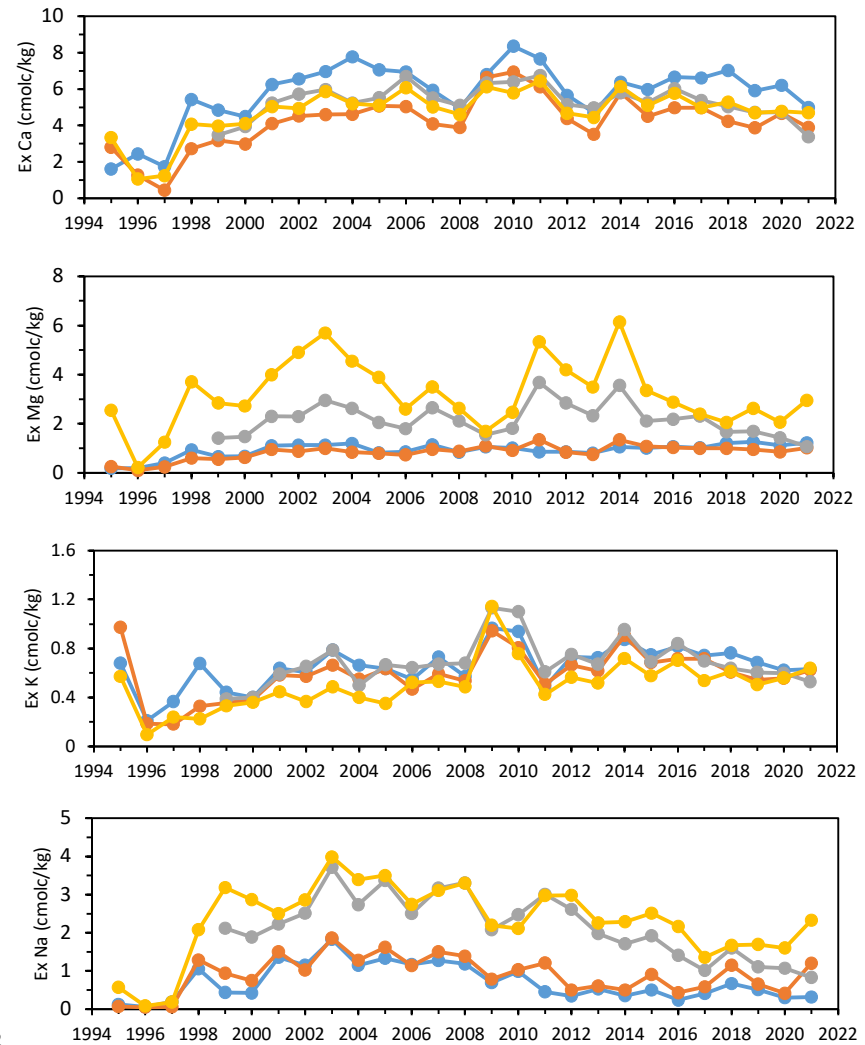
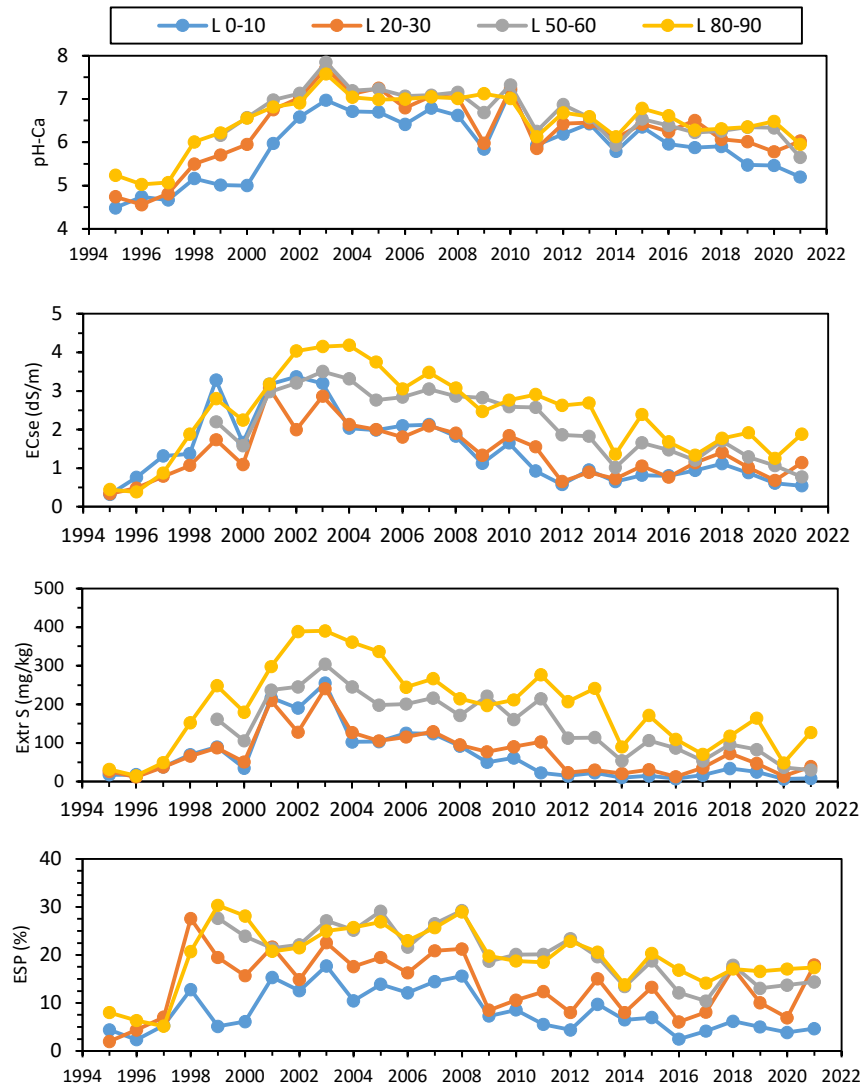
**Legend**

-  Ettamogah sample locations
-  Maryvale sample locations
-  Plantation sample locations
-  Rosevale sample locations





**Attachment B:** Average pH-Ca, ECse (dS/m), extractable S (mg/kg), ESP (%), and exchangeable cations (cmolc/kg) in effluent irrigated plantation soils since 1995.

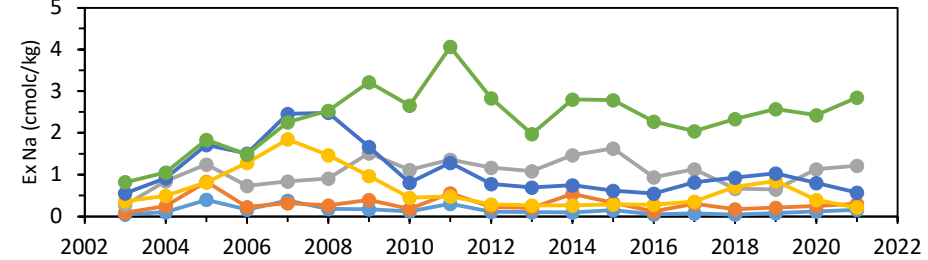
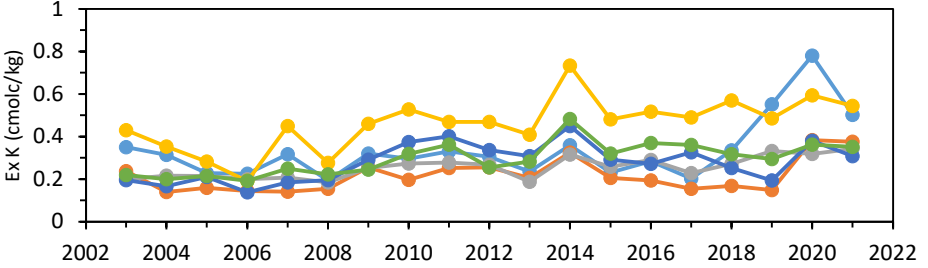
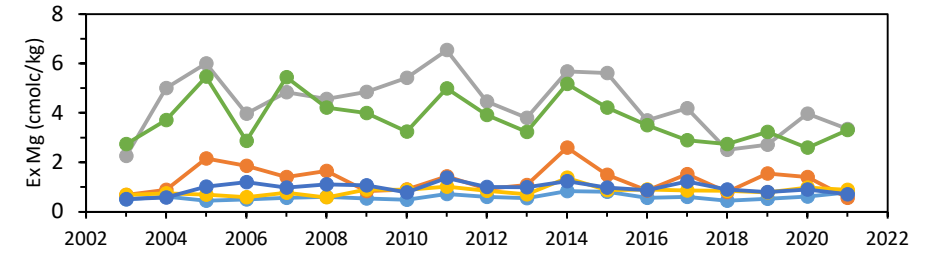
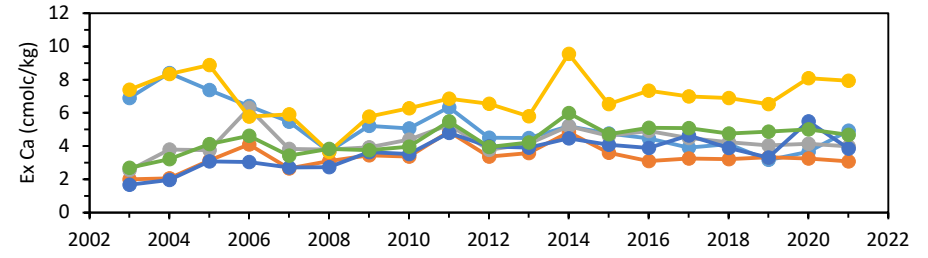
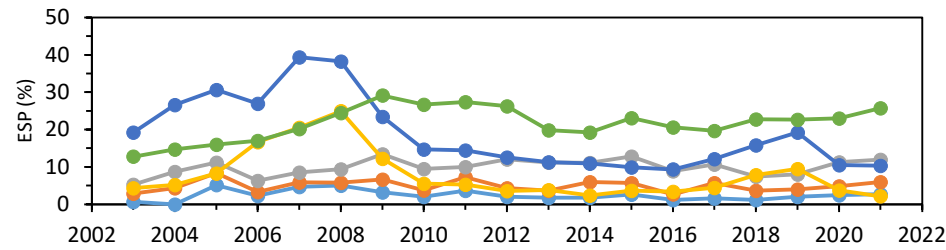
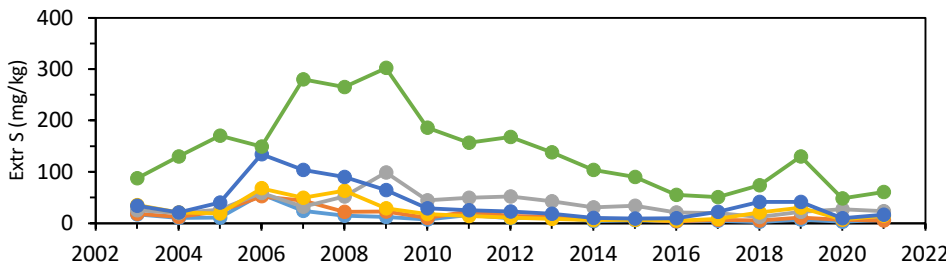
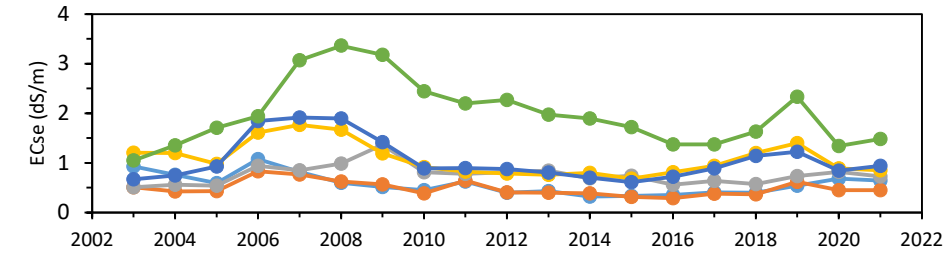
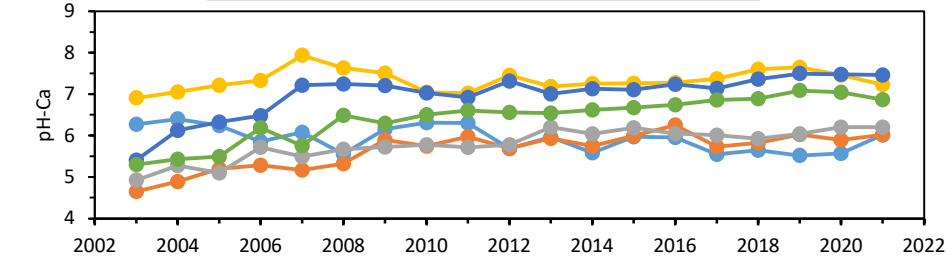


**Attachment C:** Average pH, salinity (EC), extractable S and exchangeable cations in 2021.

Site	Treatment	Layer cm	pH-Ca	pH-W	EC1:5 dS/m	Extr S mg/kg	Ex Ca cmolc/kg	Ex Mg cmolc/kg	Ex K cmolc/kg	Ex Na cmolc/kg	Sum Ex Cat cmolc/kg	Ex Ca/Mg	ESP %	ECse dS/m
Tree Plantation Ettamogah	Effluent	0-10	5.20	6.20	0.08	8.25	5.00	1.23	0.63	0.32	7.23	4.08	4.65	0.54
		20-30	6.03	7.20	0.16	38.50	3.90	1.03	0.63	1.20	6.73	3.85	17.98	1.14
		50-60	5.65	6.93	0.11	30.00	3.38	1.08	0.53	0.83	5.88	3.30	14.38	0.77
		80-90	5.95	6.95	0.27	127.25	4.70	2.95	0.64	2.33	10.60	2.03	17.40	1.87
Crops & Pastures Ettamogah, Maryvale & Rosevale	Nil	0-10	6.02	6.86	0.09	6.20	4.92	0.78	0.50	0.16	6.34	6.68	2.73	0.64
		20-30	6.02	7.14	0.06	5.20	3.08	0.56	0.38	0.30	4.30	7.24	5.96	0.45
		50-60	6.20	7.36	0.10	23.20	3.98	3.34	0.34	1.21	8.94	1.78	11.94	0.73
	Effluent	0-10	7.23	7.97	0.12	14.50	7.94	0.88	0.55	0.22	9.52	9.29	2.19	0.85
		20-30	7.46	8.43	0.13	16.25	3.84	0.70	0.31	0.57	5.47	6.06	10.30	0.94
		50-60	6.87	8.13	0.21	60.42	4.68	3.30	0.35	2.85	11.26	1.78	25.75	1.48



**Attachment D:** Average pH-Ca, ECse (dS/m), extractable S (mg/kg), ESP (%) and exchangeable cations (cmolc/kg) in crops & pastures soils since 2003.



**Attachment E:** Average water-use weighted salinity (WUW ECse) in plantation, crop and pasture soils in 2021.

Site	Irrigated (yrs)	WUW ECse (dS/m)		Plots (n)	CoVar (%)
		Average	Std Dev		
<b>Tree Plantation</b> Ettamogah - Pine & Eucalyptus	26	0.9	0.6	4	64
<b>Irrigated Crops &amp; Pastures</b> Ettamogah, Maryvale & Rosevale	18	1.0	0.4	12	38
<b>Unirrigated Crops &amp; Pastures</b>		0.6	0.3	5	51

**Attachment F:** Average salinity (WUW Ecse) in the root zones of plantation soils (0-90cm) and crops & pasture soils (0-60cm) irrigated with effluent.

