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3 October 2023

**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 (Licence version date 30-Aug-2022) 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 long-term average rainfall for Albury (measured at Hume Reservoir, 10km south of Visy Albury) is 704mm while in the year to date (2023) around 598mm has been recorded. This follows on from two wet years in 2021 and 2022 with above average rainfall recorded.

**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 testing is conducted annually on each sample for pH ($H_2O$ & $CaCl_2$), electrical conductivity, extractable sulphate, exchangeable cations (calcium, magnesium, potassium, and sodium). Physical testing is conducted every five years for Emerson aggregate stability (last conducted in 2021). 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 31 August and 1 September 2022, plantation sites 21 & 28 contained second rotation eucalyptus plantings; and sites 22 & 23 had second rotation pine plantings. Ettamogah had lucerne, pasture, and clover; Maryvale had oats and ryegrass; and Rosevale was lucerne and is now sown to a brassica radish hybrid.

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 $CaCl_2$) ranged from 5.15 to 6.00 in the upper layers (0-10cm, 20-30cm) and between 6.25 and 6.40 in the subsoil layers (50-60cm, 80-90cm). pH (1:5 $CaCl_2$) declined from the 2022 results in all layers back to levels similar to 2021.
- Average salinity (ECse) ranged from 0.53 to 0.93 dS/m in the upper layers and from 2.10 to 4.36 dS/m in the lower layers. Average salinity decreased from the 2022 results in all layers except for 80-90cm.
- Average exchangeable cations (Ca, Mg, Na) generally decreased from 2022 levels, apart from exchangeable potassium which remained relatively steady.
- Average exchangeable sodium percentage (ESP) ranged from 4.48% to 20.05%, with all soil layers experiencing decreased levels from 2022.
- Average extractable sulphur decreased from 2022 except for the subsoil (80-90cm) where it remained relatively steady.

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

- Average pH (1:5 $CaCl_2$) ranged from 5.64 to 6.40 in the un-irrigated plots, and between 7.04 and 7.33 in plots irrigated with effluent. Average pH (1:5 $CaCl_2$) increased from the 2022 results to levels similar to 2021.
- Average salinity (ECse) ranged from 0.56 to 0.80 dS/m in the un-irrigated plots, remaining steady to slightly decreasing from 2022 levels. In the irrigated plots, average ECse ranged from 0.78 to 1.53 dS/m remaining relatively stable or slightly increasing from 2022.
- Average exchangeable cations (Ca, Mg, K, Na) generally decreased from 2022 levels with some minor variation in calcium and magnesium in the subsoil (80-90cm).
- Average exchangeable sodium percentage (ESP) was recorded as 1.79% (0-10cm), 2.08% (20-30cm), and 12.64% (50-60cm) in the un-irrigated plots decreasing from 2022 levels. The ESP was recorded at 2.35% (0-10cm), 8.32% (20-30cm), and 23.36% (50-60cm) in the irrigated areas increasing from 2022 levels at depth.
- Average extractable sulphur in the un-irrigated plots was similar to or lower than 2022 levels, ranging from 5.40 to 34.40 mg/kg. Levels were similar to or slightly higher than 2022 in the effluent irrigated plots, ranging from 10.00 to 82.08 mg/kg.

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

- Average salinity in the root zone of the plantation areas was 1.5 ± 1.3 dS/m. Plantation soil salinity has decreased from 2022.
- Average salinity in the root zone of the effluent irrigated crops and pasture areas was 1.0 ± 0.4 dS/m. The average soil salinity has increased slightly from 2022.
- Average soil salinity in the root zone of the un-irrigated crops and pasture areas was 0.7 ± 0.2 dS/m. Soil salinity has remained steady from 2022.
- The coefficient of variation of average soil salinity ranged from 36% (irrigated crops & pasture) to 89% (plantation), which is variable compared to previous monitoring results.

**Discussion**

The tree plantation soil monitoring results show decreases in salinity, extractable sulphur, and sodium compared to 2022 when marked increases were observed compared to 2021. Soil pH and exchangeable cations generally returned to 2021 levels with some variation at depth. Salinity declined to lower levels but has steadied at depth after two years of rising trends.

Within the pasture plots (both un-irrigated and irrigated) some minor seasonal variations are noted, these likely attributable to changes in irrigation water quality and the amount of irrigation occurring in 2023 owing to the above average rainfall in 2022 and from January to June 2023.

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 tree plantation, crop, and pasture areas, however average levels of soil salinity remain well below the Load Based Licencing threshold of 4.0 dS/m.

It is recommended that the practice of an annual review of the cropping systems and irrigation management is conducted to ensure the maximum sustainable assimilation of nutrients and hydraulic load is occurring.

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

Yours sincerely

**David McMahon** CEnvP SC
BAppSc SA
GradDip WRM
MEnvMgmt
MALGA MEIANZ MSSA

**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

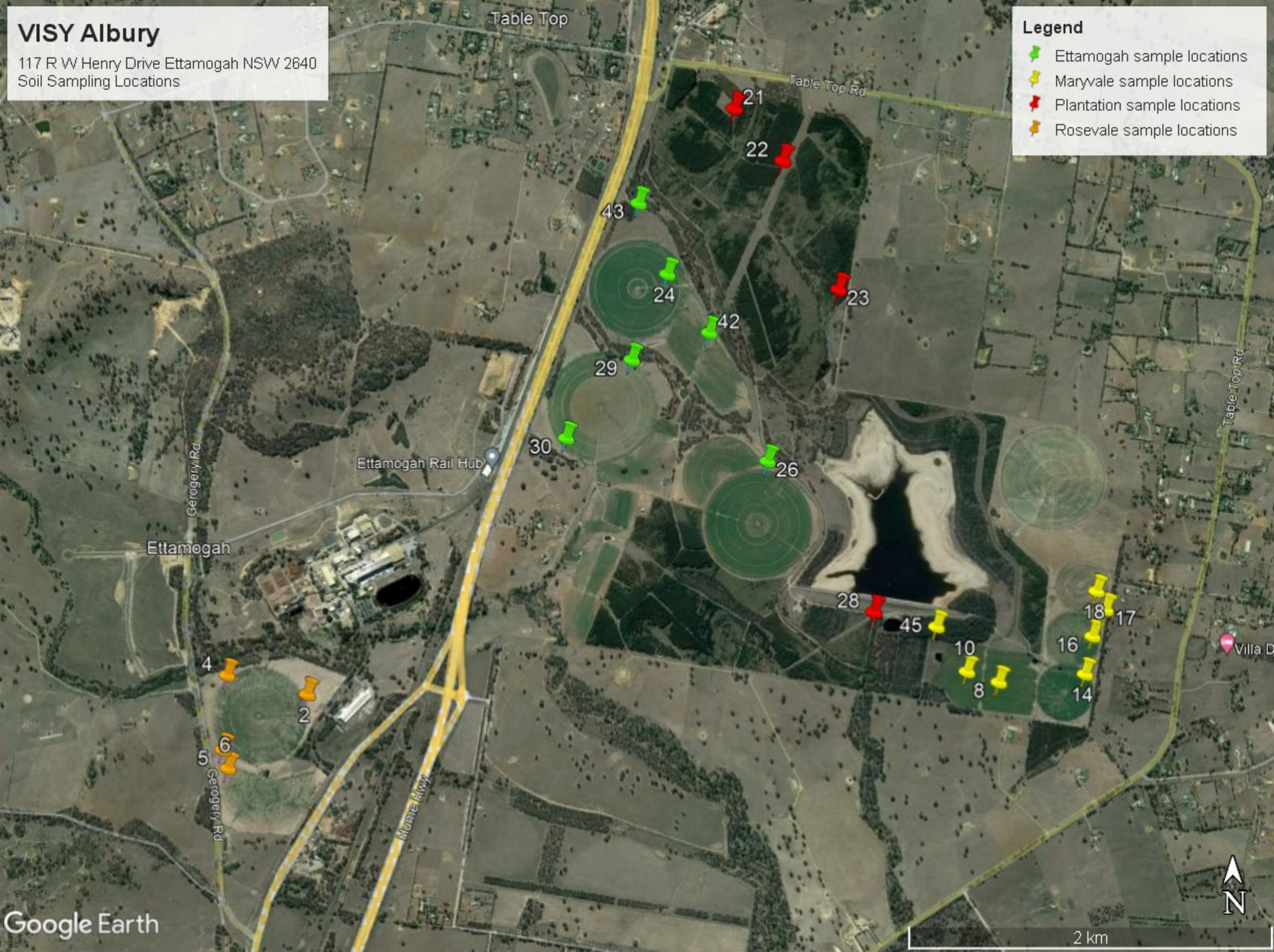
**B.** Plantation graphs

**C.** Tabulated results

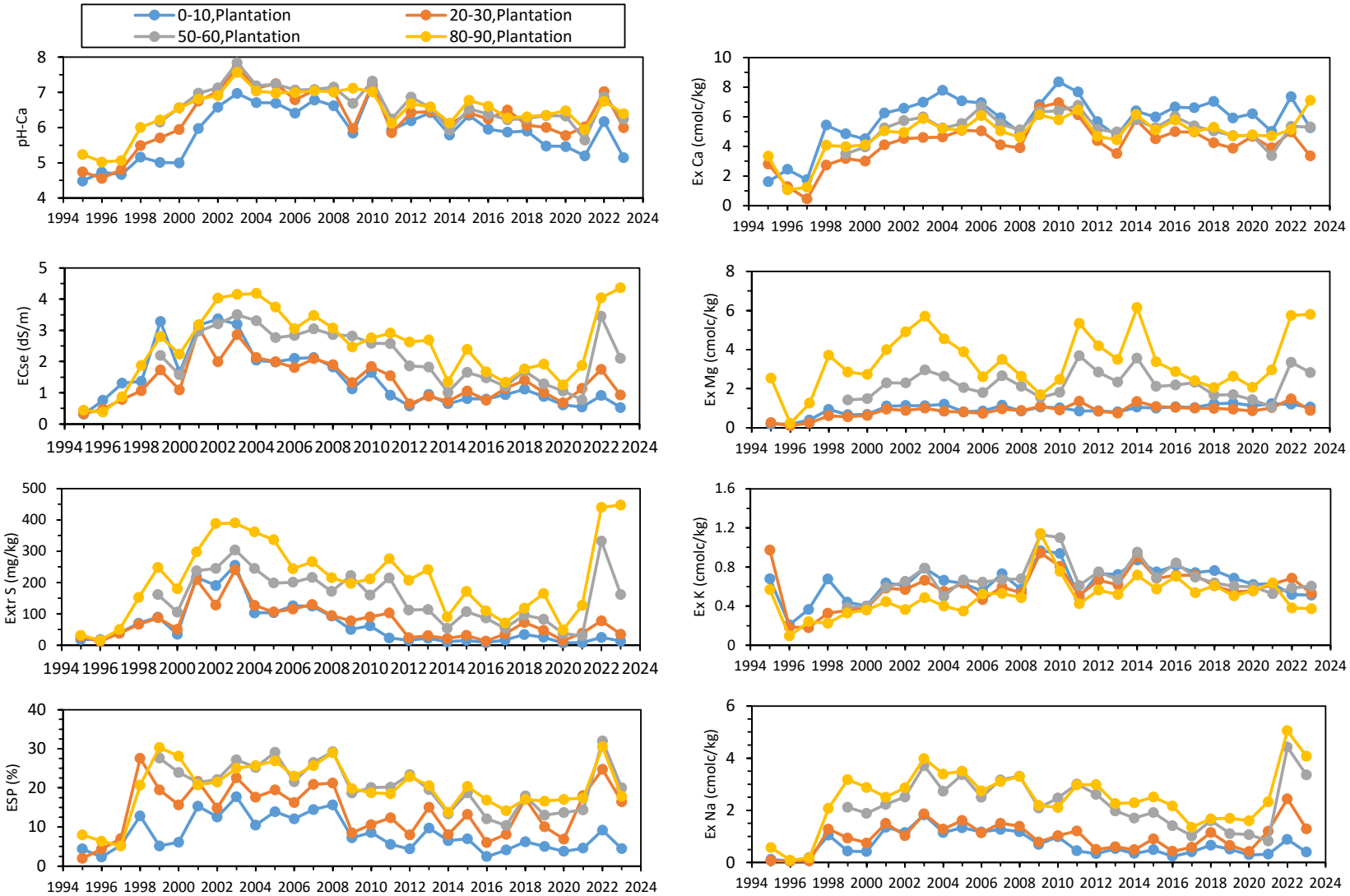
**D.** Crops and pastures graphs

**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
Table Top
Table Top Rd
Ettamogah Rail Hub
Ettamogah
Gerogery Rd
Hume Hwy
21
22
43
24
23
42
29
30
26
28
45
10
8
18
17
16
14
4
2
6
5
N
2 km
Google Earth

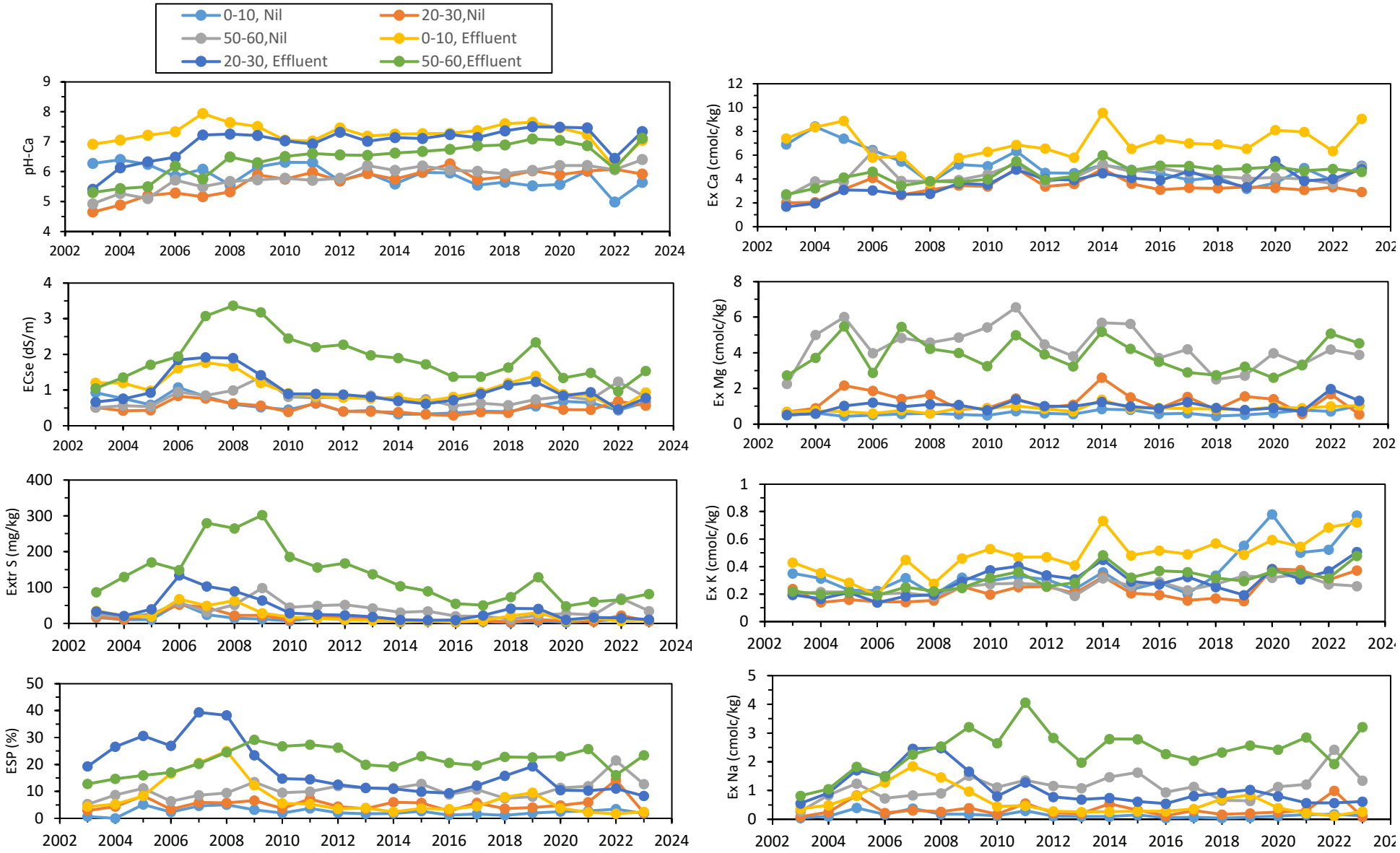
**Attachment B:** Average pH-Ca, ECse (dS/m), extractable S (mg/kg), ESP (%), and exchangeable cations (cmolc/kg) in effluent irrigated plantation soils since 1995.



**Attachment C:** Average pH, salinity (EC), extractable S and exchangeable cations in 2023.

| Site | Treatment | Layer | pH-Ca | pH-W | EC1:5 | Extr S | Ex Ca | Ex Mg | Ex K | Ex Na | Sum Ex Cat | Ex Ca/Mg | ESP | ECse |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | cm | | | dS/m | mg/kg | cmolc/kg | cmolc/kg | cmolc/kg | cmolc/kg | cmolc/kg | | % | dS/m |
| **Tree Plantation Ettamogah** | **Effluent** | **0-10** | 5.15 | 6.15 | 0.08 | 12.75 | 5.25 | 1.05 | 0.51 | 0.40 | 7.40 | 5.28 | 4.48 | 0.53 |
| | | **20-30** | 6.00 | 7.18 | 0.13 | 34.50 | 3.35 | 0.88 | 0.53 | 1.29 | 6.48 | 4.80 | 16.48 | 0.93 |
| | | **50-60** | 6.25 | 7.10 | 0.30 | 161.25 | 5.30 | 2.83 | 0.61 | 3.36 | 12.13 | 2.45 | 20.05 | 2.10 |
| | | **80-90** | 6.40 | 6.95 | 0.62 | 447.75 | 7.10 | 5.80 | 0.37 | 4.08 | 17.43 | 1.95 | 17.78 | 4.36 |
| **Crops & Pastures Ettamogah, Maryvale & Rosevale** | **Nil** | **0-10** | 5.64 | 6.52 | 0.09 | 9.20 | 5.12 | 1.04 | 0.77 | 0.12 | 7.26 | 5.28 | 1.79 | 0.66 |
| | | **20-30** | 5.92 | 6.86 | 0.08 | 5.40 | 2.90 | 0.54 | 0.37 | 0.09 | 4.04 | 5.16 | 2.08 | 0.56 |
| | | **50-60** | 6.40 | 7.50 | 0.11 | 34.40 | 5.00 | 3.88 | 0.26 | 1.35 | 10.54 | 1.36 | 12.64 | 0.80 |
| | **Effluent** | **0-10** | 7.04 | 7.79 | 0.13 | 10.00 | 9.05 | 1.03 | 0.72 | 0.27 | 11.03 | 9.33 | 2.35 | 0.93 |
| | | **20-30** | 7.33 | 8.38 | 0.11 | 10.58 | 4.82 | 1.30 | 0.51 | 0.62 | 7.20 | 5.93 | 8.32 | 0.78 |
| | | **50-60** | 7.11 | 8.18 | 0.22 | 82.08 | 4.59 | 4.53 | 0.48 | 3.21 | 12.80 | 1.56 | 23.36 | 1.53 |

**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 2023.

| Site | Irrigated | WUW ECse (dS/m) | | | |
|---|---|---|---|---|---|
| | (yrs) | Average | Std Dev | Plots (n) | CoVar (%) |
| **Tree Plantation**<br>**Ettamogah - Pine & Eucalyptus** | 28 | 1.5 | 1.3 | 4 | 89 |
| **Irrigated Crops & Pastures**<br>**Ettamogah, Maryvale & Rosevale** | 20 | 1.0 | 0.4 | 12 | 36 |
| **Unirrigated Crops & Pastures** | | 0.7 | 0.2 | 5 | 35 |

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