'Surveillance sampling to monitor the pH of agricultural soils in areas of existing and emerging soil acidity on Eyre Peninsula 2019-2023'

PROJECT REPORT 2019-2020

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This project is supported by Natural Resources Eyre Peninsula with funding from the Australian Government's National Landcare Program.

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Disclaimer

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EXECUTIVE SUMMARY

Soil acidity is a significant issue on Lower and Eastern Eyre Peninsula with more than 186,000 hectares (7%) of agricultural land in the region prone to acidification. Projects on Eyre Peninsula suggest that the rate of acidification is occurring faster on average with current farming practices than historical estimates and that, if not treated with adequate applications of lime, a further 509, 000 ha (19%) in the region is at risk of acidifying over the next 20-50 years (Forward and Hughes 2019).

This report details activities and results from the Natural Resources Eyre Peninsula (NREP) '*Surveillance sampling to monitor the pH of agricultural soils in areas of existing and emerging soil acidity on Eyre Peninsula 2019-2023'* project, supported by the NREP Regenerative Agriculture Program and funded by the Australian Government's National Landcare Program. The 2019/20 project activities consisted of 2 main components which were;

- **Component 1. Undertake soil sampling and reporting for soil pH changes on at least 15 established surveillance sites on Lower Eyre Peninsula and Eastern Eyre Peninsula**
- **Component 2. Undertake sampling of 10 surveillance sites on target soil types in areas with emerging or potential soil acidity issues.**

Soil sampling on 16 existing surveillance sites in March 2020 showed a reduction in the proportion of sites with surface soils below the target pH of 5.5 $CaCl_2$ since they were last sampled in 2013-2015. This reflects the application of lime to around 50% of these sites by landholders during this period, and is indicative of the upward trend of lime applications in the region in recent years (Forward and Hughes, 2019).

There is still a relatively large number of sites with subsurface layers below 5.0 $CaCl_2$, with surface lime applications not necessarily addressing this issue at depth.

Sampling of 10 sites in the 'emerging' soil acidity zone showed 20% of sites with surface (0-5 and 5-10 cm layers) at or below the target of 5.5 $CaCl_2$, confirming the potential for the target soils in these districts to acidify. This is particularly so in the 5-10 cm subsurface layers, where lower organic carbon levels restrict the soils ability to buffer pH change. Combined with a lack of soil mixing given current farming practices, some soil stratification of acidity is being identified which should be considered when sampling for soil pH in long term no-till paddocks.

Organic carbon and salinity (EC)\ values were within the expected ranges for the soil types and region. Relatively high concentrations of phosphorus (P) on many existing acidity sites may provide the opportunity for landholders to reduce P fertiliser applications for a time and instead apply lime to address soil acidity.

1 INTRODUCTION

Soil acidity is a significant issue on Eastern and Lower Eyre Peninsula estimated to cost the region between $16 and $19 million per year due to lost production (Forward and Hughes 2019). Surface soil acidity (0 – 10 cm) occurs on approximately 7% (186,000 ha) of the region's agricultural land, while there are about 4% (102,000 ha) with sub-surface acidity (approx. 10-20 cm depth), and 1% (20,000 ha) with subsoil acidity (below approx. 20-30 cm depth). The development of acidity on Eyre Peninsula in previously unaffected areas has been recognised for some time. High-production farming practices will continue to acidify these areas, with the extent of acidic land increasing unless adequate ongoing treatment is implemented.

A number of projects have been delivered on Lower Eyre Peninsula since 2010 looking to quantify acidification rates on Eyre Peninsula. Results from these projects indicate that under current farming practices and recent seasonal conditions acidification is happening faster than was historically estimated (Masters 2016). It is predicted that unless regional lime use rates are maintained at more than 21,000 tonnes per year soil acidification will continue with a further 509,000 ha (19%) of agricultural land in Central, Eastern and Lower Eyre Peninsula (excluding areas with calcareous soils) at risk. This will occur more quickly on soils with low pH buffering capacity (i.e. sandy textured soils) where high nitrogen inputs are used, even though the current soil pH may be close to neutral (e.g. pH 6 to 7 $CaCl_2$) (Forward and Hughes 2019).

Average lime use since 1999 is around 77% of the estimated topsoil acidification rate (21,000t for acid soils below 5.5 $CaCl_2$ and 35,000t for all acid prone soils), so a lime deficit has accumulated. A further 213,000 tonnes of lime is estimated to be needed to raise pH of acidic topsoils above 5.5 ($CaCl_2$) (Forward and Hughes 2019). However, increased lime sales in the region with estimated sales of 62,000 t in both 2018/19 and 2019/20 has started to reduce this deficit (Forward and Hughes, 2019 and Masters, unpublished 2020).

This report details activities and results from the NREP 'Surveillance sampling to monitor the pH of agricultural soils in areas of existing and emerging soil acidity on Eyre Peninsula 2019-2023' project, supported by the NREP Regenerative Agriculture Program and funded by the Australian Government's National Landcare Program in 2019/20, which were;

- **Component 1. Undertake soil sampling and reporting for soil pH changes on at least 15 established surveillance sites on Lower Eyre Peninsula and Eastern Eyre Peninsula**
- **Component 2. Undertake sampling of 10 surveillance sites on target soil types in areas with of emerging or potential soil acidity issues.**

2 SOIL SAMPLING

2.1 SITE IDENTIFICATION AND METHODOLOGY

2.1.1 EXISTING SURVEILLANCE SITES

There were some 65 surveillance sites on Lower and Eastern Eyre Peninsula established in 2010, 40 of which were resampled by PIRSA between December 2013 and February 2015 to monitor pH change under agricultural production (Masters 2015). Under the Natural Resources Eyre Peninsula 'Restoring soil pH' project 20 of these 40 sites were resampled by PIRSA in March 2019 (Masters 2019[1]). In 2019-20 the project aimed to revisit at least 15 more of these sites to measure pH changes since the previous sampling, and 16 'existing' surveillance sites (13 in Lower EP and 3 in the Cleve Hills) were sampled by PIRSA and NREP staff in March 2020.

Sites were sampled by returning to the GPS co-ordinate in the southwest corner of the 25 x 25 m sampling area and taking 10 soil cores at random within this area to a depth of 20 cm. Surface (0-10 cm) and subsurface (10-20 cm) layers were bulked separately and sent to EP Analysis for analysis of pH, organic carbon, Colwell P and extractable aluminium (Appendix 1).

2.1.2 NEW (EMERGING) SURVEILLANCE SITES

In 2019 PIRSA sampled ten new monitoring sites in districts where soil acidity is considered to be an 'emerging' or potential issue and these sites were added to the database of soil acidity surveillance sites in the region (Masters 2019[2]). An additional 10 new 'emerging' acidity surveillance sites were sampled in March 2020.

As soil acidification occurs more rapidly on low buffering soils in high nitrogen input systems it was decided to target sandy soils in the medium rainfall zone for sampling. In 2019 the project concentrated in the Yeelanna and Karkoo districts (Masters 2019[2]) and in 2020 the Ungarra/Moody Centre and Wharminda districts were targeted (Figure 1 and Appendix 3).

In consultation with local advisors, farming systems groups and NRM project officers a list of potential landholder contacts was developed. Landholders were phoned directly with discussion of the emerging acidity issue and the project and asked whether they had a site that could be used to monitor soil pH. Of the 10 new surveillance sites 3 are located in the Ungarra/Moody Centre district with 7 in the Mt Hill/Wharminda district. (Figure 1).

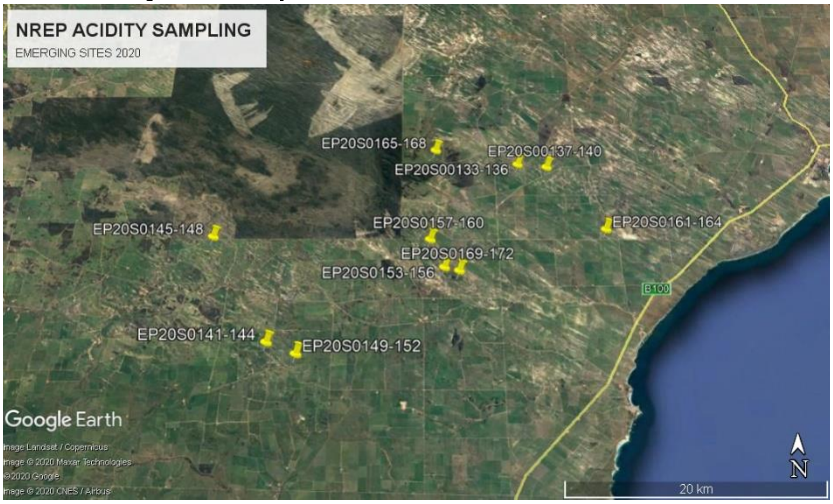


Figure 1. **Map showing new surveillance sampling sites, 2020.**

Soil samples were taken to a depth of 20 cm at 10 random locations within a 25 x 25 m sampling area. These samples were bulked in 5 cm increments (0-5, 5-10, 10-15 and 15-20 cm) and a subsample sent to EP Analysis for analysis of pH, EC and extractable Aluminium (Appendix 4 and 5).

As the soil was extremely dry at the time of sampling, and to avoid contamination of the samples from dry surface soil falling down the sampling tube, a combination of sampling techniques was used. The surface layers (0-5 and 5-10 cm) were taken using a collection vial inserted to the appropriate depth and removed using a trowel. The soil was then scraped back to reveal a clean sampling surface at 10 cm below the soil surface and the lower depths were sampled using a hydraulic soil sampling probe. Composite samples from the 0-10 and 10-20 cm depths were also sent for analysis of soil organic carbon (OC) and Colwell P (Appendix 6).

2.2 RESULTS OF SAMPLING

Laboratory results were collated and reviewed. Soil pH values were charted against sample depth with these graphs providing a visual representation of the variation in pH down the profile (pH stratification) (Appendix 2). A detailed site report was sent to each landholder.

2.2.1 EXISTING SURVEILLANCE SITES

pH and Aluminium results

Of the 16 existing surveillance sites sampled 9 (56%) had surface soils (0-10 cm) below the target value of 5.5 $CaCl_2$ and 7 sites (44%) were below 5.0 $CaCl_2$ at the surface (Figure 2). These results show an overall reduction in the proportion of sites with surface soils below 5.5 $CaCl_2$ (from 69% of sites when surveillance sampling was last undertaken) (Masters 2015) and were similar to the results from the 20 sites sampled in 2019 (Masters 2019). There was however a slight increase in the proportion of sites with surface soils below 5.0 $CaCl_2$, increasing from 38% when the sites were last sampled to 44% in 2020. The proportion of sites with subsurface layers below the critical value of 5.0 $CaCl_2$ has slightly reduced since sites were last sampled (down from 56%), however half of the sites sampled still have subsurface layers with pH below this value.

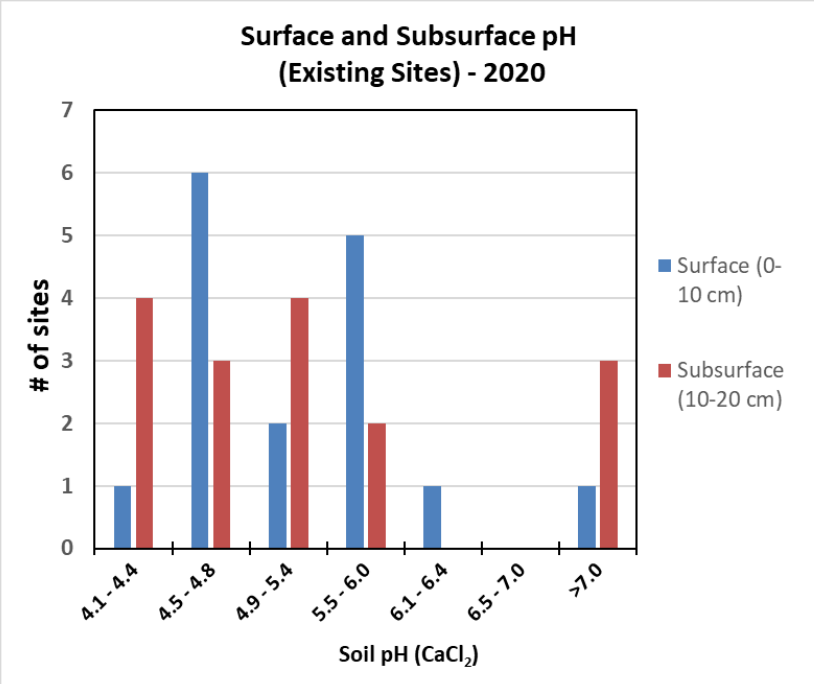


Figure 2. **Range of surface and subsurface pH values on EP surveillance sites (2020)**

pH values ranged by 2.9 pH units in the 0-10 cm layer (from 4.4 to 7.3 $CaCl_2$) and 3.5 units in the 10-20 cm layer (from 4.1 to 7.6 $CaCl_2$).

When these results were compared with those from the last sampling event, there was no mean pH change in the 0-10 cm layer. The maximum pH increase during this period was 1.1 pH units, and pH at one site decreased by 1.9 pH units in the 10 years since that site was last sampled. Although across all sites there was an average pH decline in the 10-20 cm layer by 0.2 pH units since the sites were last sampled this average was skewed by one site which had not been sampled for 10 years and with a 3.1 unit pH decline in the 10-20 cm layer since it was last sampled. Disregarding this site there was no net pH change on the remaining sites since sampling in 2013-2015. Whilst on-site spatial variation might account for some variability in the results, half of the sites had been limed at rates of between 1.5 and 5.0 t/ha since they were last sampled (A full summary of the pH and aluminium data can be found in Appendix 1). Current pH levels for each site were graphed against previous results showing the change in pH at the site over time (Figure 3 and Appendix 2). and included in individual site reports which were sent to landholders.

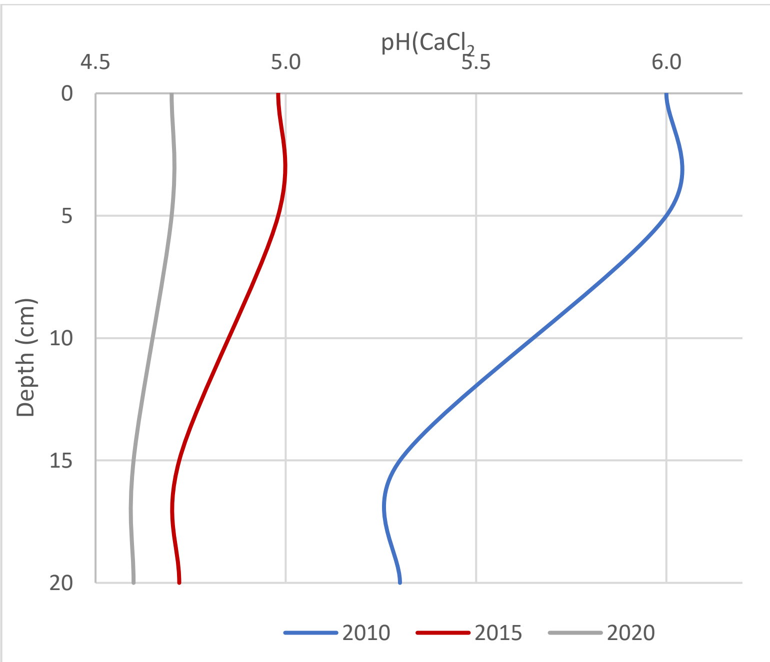


Figure 3. **Example of graph showing pH change over time (Site EP10M0002)**

On average the concentration of aluminium present in forms which can affect plant growth was less (by 0.7 mg/kg) than when the site were last sampled. The exception was at site EP10S0031/32 where a reduction in pH from 4.3 in 2013 to 4.1 in 2020 saw a net increase in available aluminium in the 10-20 cm layer by 1.2 mg/kg to 3.2 mg/kg (well above the critical concentration at which the growth of sensitive wheat roots can be affected).

Organic Carbon and Colwell P results

All sites had surface soil phosphorus (P) levels above that considered adequate for crop production (20-35 mg/kg depending on soil type), with 8 sites (50%) having surface P above 50 mg/kg. A high proportion of sites (37%) also had Colwell P values above 20 mg/kg in the 10-20 cm layer, indicating some fertiliser leaching at these sites.
Tables??

2.2.2 NEW (EMERGING) SURVEILLANCE SITES

pH and Aluminium results

Across the 10 sites soil pH at the surface (0-5, 5-10 cm layers) varied by around two pH units. In the 0-5 cm layer pH varied from 4.5 to 6.5 $CaCl_2$ (with an average pH of 5.7 $CaCl_2$) (Table 1). The lowest pH reading in the 5-10 cm layer was 4.3 and highest 6.4 $CaCl_2$ (with an average value of 5.6 $CaCl_2$) (Table 1).

Table 1: Analysis of pH data at different sampling depths.

SOIL DEPTH (cm)	MIN pH (CaCl2)	MAX pH (CaCl2)	MEAN pH (CaCl2)	Range pH (units)
0-5	4.5	6.5	5.73	2
5-10	4.3	6.4	5.57	2.1
10-15	4.3	7.7	6.08	3.4
15-20	4.5	8	6.65	3.5

The subsurface layers had greater pH variation (3.4 units in the 10-15 cm layer and 3.5 units at 15-20 cm) with the average pH in these layers above 6.0 $CaCl_2$. Around 50% of sites had pH values which were at least 0.2 units lower in the 5-10 cm layer than at 0-5 cm, highlighting the stratification of pH on these sites (Appendix 4). At site EP20S0165-168 (KITSON) the 5-10 cm layer was 0.7 pH units lower than at the surface.

Two out of the 10 sites (20%) had pH values below 5.0 $CaCl_2$ in at least one layer. Only one site (in the 5-10 cm layer) had extractable aluminium levels high enough to affect root growth on sensitive plants (i.e. >2mg/kg). Extractable aluminium was above the critical value at which root growth can be affected (2 mg/kg) on only one of these sites (in the 5-10 cm layer at EP20S0141-144, Fatchen)

Organic Carbon and Colwell P results

Soil organic carbon values were in the range expected for the targeted soil type (Appendix 6 and Table 2). One of the very sandy sites (EP20S0145-148 Modra) had very low soil organic carbon (<0.5%) at the surface (0-10 cm). Without organic carbon to buffer pH change these soils are at risk of acidifying very quickly.

Table 2. Analysis of Soil Organic Carbon and Colwell P results

	Soil organic carbon in surface layer (0-10 cm)	Soil organic carbon in subsurface layer (10-20 cm)	Cowell P in surface layer (0-10 cm)	Cowell P in subsurface layer (0-10 cm)
min	0.3	0.2	13	11
max	1.3	0.7	30	23
average	0.9	0.4	23	18
range	1.0	0.5	16	12

Most sites (70%) had surface soil Colwell P levels above the minimum considered adequate for crop production on sand (20 mg/kg). Four sites also had Colwell P values above 15 mg/kg in the 10-20 cm layer, indicating some fertiliser leaching at these sites.

3 SUMMARY AND CONCLUSIONS

Soil analysis showed a reduction in the proportion of surveillance sites with surface soils below the target pH of 5.5 $CaCl_2$ since last sampled in 2013-2015. However there was a slight increase in the proportion of sites with surface pH below 5.0 $CaCl_2$. This is likely to reflect the high proportion of sites (around 50%) where lime has been applied since they were last sampled, with pH increasing above 5.5 $CaCl_2$ on limed sites and further acidifying below 5.0 $CaCl_2$ on sites where lime had not been applied. This points to some gains in the management of soil acidity in known acid prone areas in the region since 2015. This is supported by increased lime sales in the region in recent years (Forward and Hughes, 2019). Despite a slight reduction since 2015, there is still a relatively high proportion of sites with subsurface layers below 5.0 $CaCl_2$, with surface lime applications not necessarily addressing this issue at depth.

Similar to the 2019 results, soil analysis from sites in the ‘emerging’ soil acidity areas confirm the potential for the target soils in these districts to acidify, particularly in the 5-10 cm subsurface layers where lower organic carbon levels restricts the soil’s ability to buffer pH change. Combined with a lack of soil mixing given current farming practices, some soil stratification of acidity is being identified which should be considered when sampling for soil pH in long term no-till paddocks. As in 2019, organic carbon and soil P values at these sites are within the expected ranges for the soil types and region.

4 REFERENCES AND FURTHER INFORMATION

4.1 REFERENCES

Forward, G. and Hughes, B (2019) ‘*Soil acidity status report for the Eyre Peninsula Natural Resources Management Region*’ DEW, September 2019.

Masters, B (2016) ‘Managing Soil Acidity on Eyre Peninsula’, Final Project Report, PIRSA, June 2016

Masters, B. (2015) ‘*Awareness of the effects of acidity and low pH on lower EP soils’* Final Project Report, Rural Solutions SA. July 2015.

Masters, B. (2019[1]) *‘Restoring Soil pH balance in areas with existing soil acidity 2018-2019.* Final Project Report, PIRSA. June 2019.

Masters, B. (2019[2]) ‘Increase awareness of potential acidification on at-risk agricultural land on Lower Eyre Peninsula *2018-2019’.* Final Project Report, PIRSA. June 2019.

4.2 ABBREVIATIONS USED IN THIS REPORT

Al -	Aluminium
cm-	Centimetres
DEW–	Department for Environment and Water.
EC-	Electrical Conductivity; an indicator of soil salinity
EP -	Eyre Peninsula
EEP -	Eastern Eyre Peninsula.
EPNRM -	Eyre Peninsula Natural Resources Management Board
FASC-	Farming Acid Soils Champions
ha-	hectares
LEADA -	Lower Eyre Agricultural Development Association.
LEP –	Lower Eyre Peninsula
mg/kg -	Milligrams per kilogram, a measure of analyte concentration in soil.
N-	Nitrogen
NLP-	National Landcare Program
NREP-	Natural Resources Eyre Peninsula
P-	Phosphorus
OC -	Organic Carbon
pH-	Potential hydrogen; a measure of soil acidity and alkalinity
pH ($CaCl_2$) -	pH in calcium chloride solution
PIRSA-	Primary Industries and Regions SA
t-	tonnes
t/ha -	tonnes per hectare

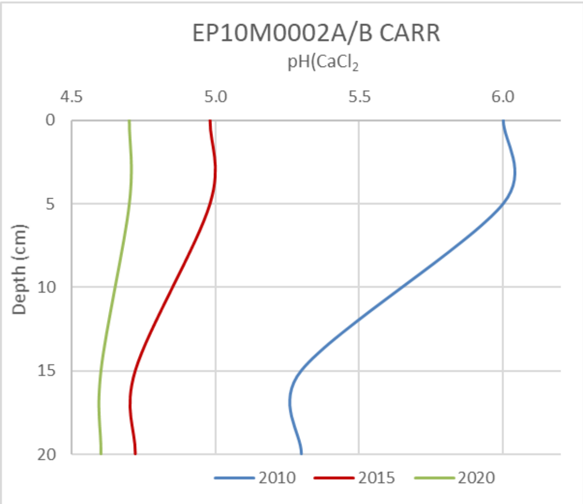
5 APPENDICIES

5.1 RESULTS OF PH ANALYSIS FROM SURVEILLANCE SAMPLING (EXISTING SITES) – MARCH 2020

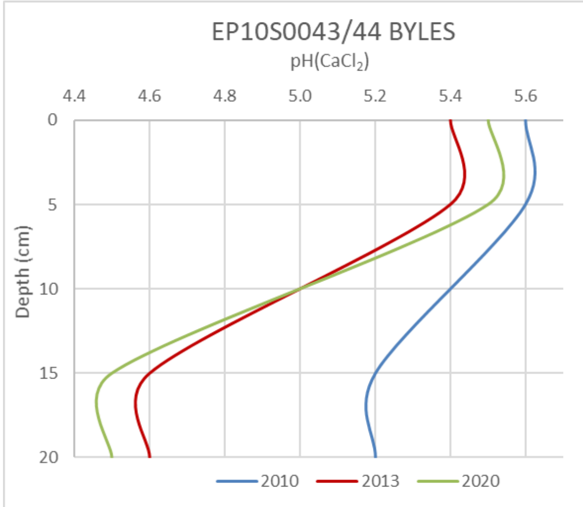
SITE_ID	pH 2013/15 (0-10 cm)	pH 2020 (0-10 cm)	pH 2013/15 (10-20 cm)	pH 2020 (10-20 cm)	Change in pH since previous sampling (0-10 cm)	Change in pH since previous sampling (10-20 cm)	Ext Alum. 2020 (0-10 cm)	Ext Alum. 2020 (10-20 cm)	Change in Alum since previous sampling. (0-10 cm)	Change in Alum since previous sampling. (10-20 cm)	Lime application: 2013-2020
	pH CaCl2	pH CaCl2	pH CaCl2	pH CaCl2	change units	change units	mg/kg	mg/kg	change units	change units	
EP10M0002A/B	5.0	4.7	4.7	4.6	-0.3	-0.1	0.5	0.7	-0.6	-1.4	1.5 t/ha in 2018
EP10S0043/44	5.4	5.5	4.6	4.5	0.1	-0.1	0.2	0.8	NR	-1.0	2.5 t/ha in 2016
EP10S0031/32	5.0	4.8	4.3	4.1	-0.2	-0.2	0.4	3.2	-0.4	1.2	NIL
EP10S0033/34	4.8	4.8	4.4	4.4	0.0	0.0	0.5	1.4	-0.9	-1.0	NIL
EP10S0037/38	5.3	4.8	6.2	5.8	-0.5	-0.4	0.2	<0.1	NR	NR	NIL
EP15B00 KOPPIO3A/B	4.8	5.2	4.8	5.1	0.4	0.3	0.2	0.1	-0.7	0.0	NIL
EP10M011/12	4.9	4.8	4.7	4.3	-0.1	-0.4	0.5	0.7	-0.1	0.2	NIL
EP10M015/16	4.2	4.8	4.4	4.2	0.6	-0.2	0.6	1.2	-3.6	-0.2	3 t/ha in 2016
EP10S0067/68	6.0	6.3	6.5	7.6	0.3	1.1	<0.1	<0.1	NR	NR	2.5 t/ha (split application 2018/19)
EP10S0069/70	5.2	5.7	5.3	5.1	0.5	-0.2	0.1	0.1	NR	NR	2.0 t/ha in 2016
EP10S0077/78	7.5	7.3	7.7	7.6	-0.2	-0.1	<0.1	<0.1	NR	NR	NIL
EP10S0079/80	4.7	5.8	4.9	4.9	1.1	0.0	0.1	0.4	0.1	0.4	5 t/ha (split applications of 2.5 t/ha each 2015 and 2019
EP10M0008A/B	4.5	5.0	4.8	5.0	0.5	0.2	0.3	0.1	-1.1	-0.1	NIL
EP10S0051/52	5.9	5.8	6.0	5.7	0.0	-0.3	0.1	0.1	0.0	0.0	Approx. 0.5 t/ha in 2015
EP10S0055/56	5.9	5.6	7.53	7.4	-0.3	-0.1	<0.1	<0.1	NR	NR	2 t/ha in 2014
EP10S0029/30	6.3	4.4	7.7	4.6	-1.9	-3.1	0	1.0	0.0	0	NIL

NR (Not reported) – 2013/15 sample not analysed for extractable aluminium as pH was above 5.0 $CaCl_2$ at the time of sampling. Values highlighted in green represent an improvement in soil condition with values in red representing a decline in resource condition.

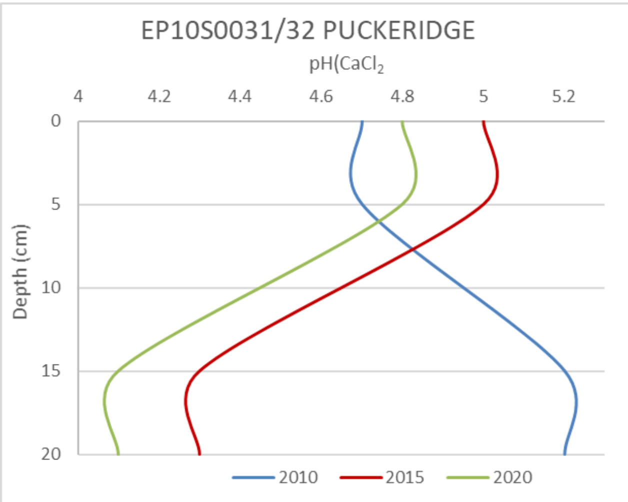
5.2 CHANGE IN PH OVER TIME PROFILE CHARTS



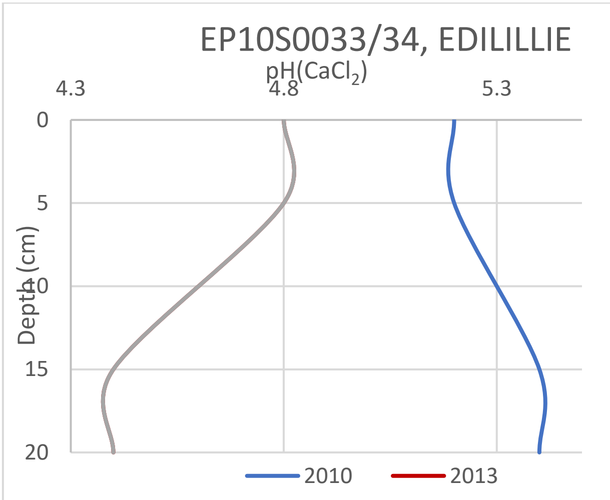
5.2.1 EP10M0002A/B CARR, KOPPIO



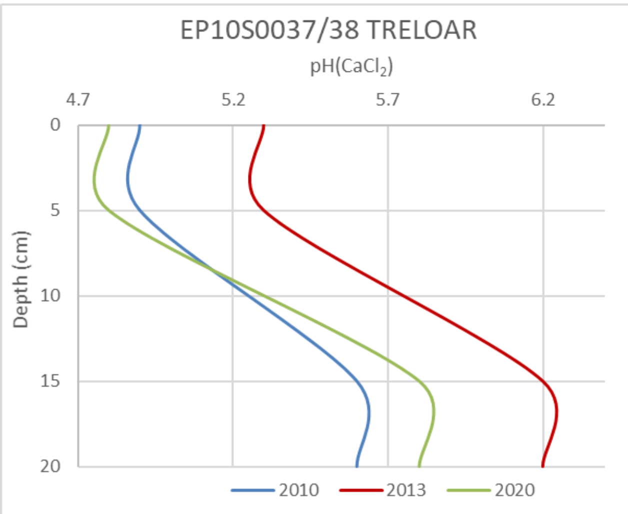
5.2.2 EP10S0043/44 BYLES, WANILLA



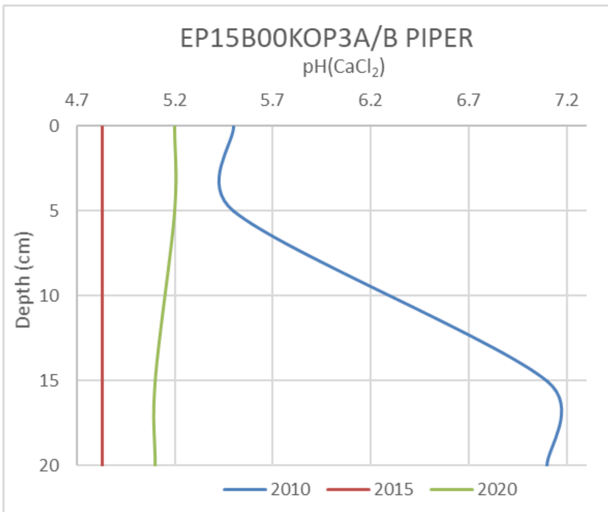
5.2.3 EP10S0031/32 PUCKERIDGE, WANILLA



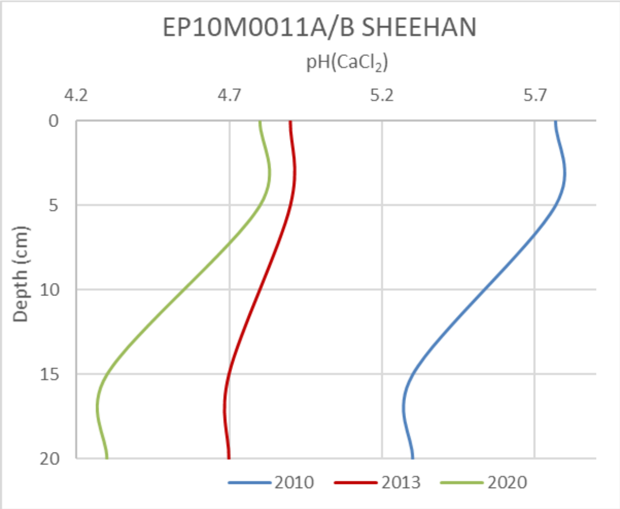
5.2.4 EP10S0033/34, EDILILLIE

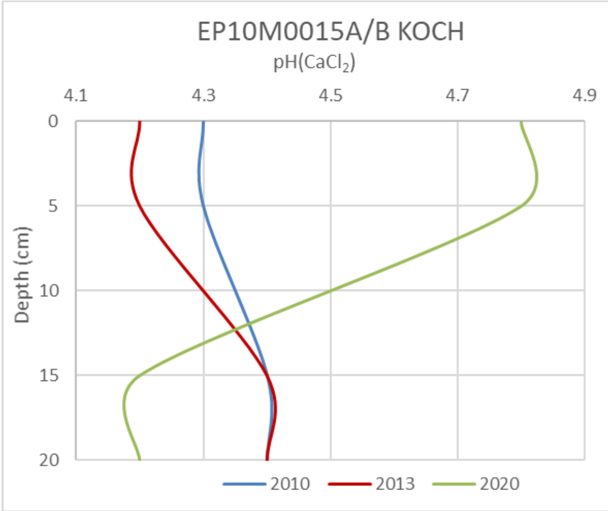


5.2.5 EP10S0037/38 TRELOAR, EDILLILIE



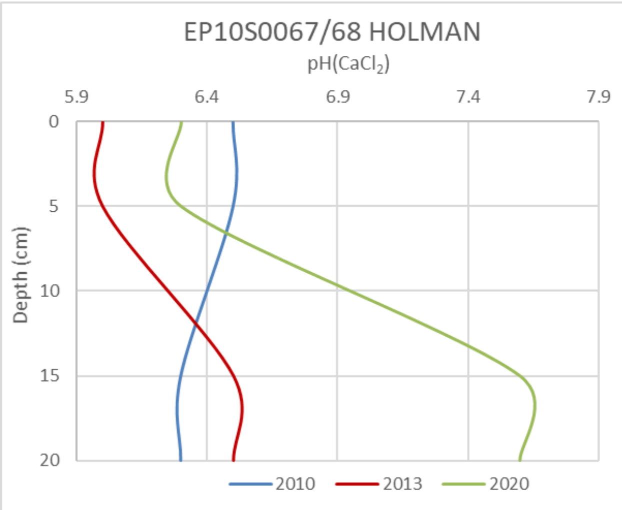
5.2.6 EP15BOOKOP3A/B PIPER, KOPPIO

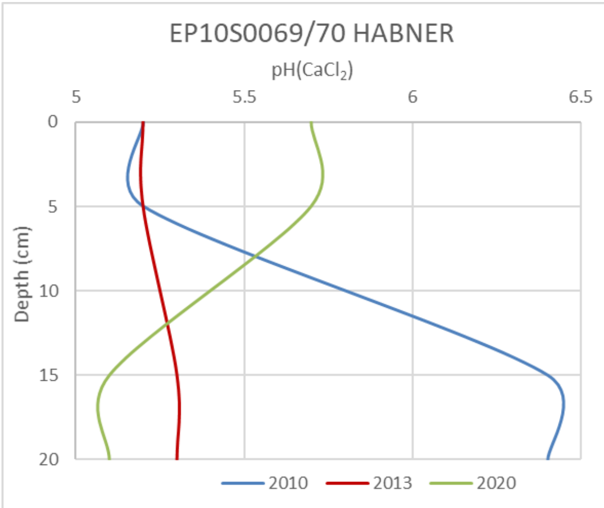




5.2.7 EP10M0011A/B SHEEHAN (CLAUGHTON), CUMMINS

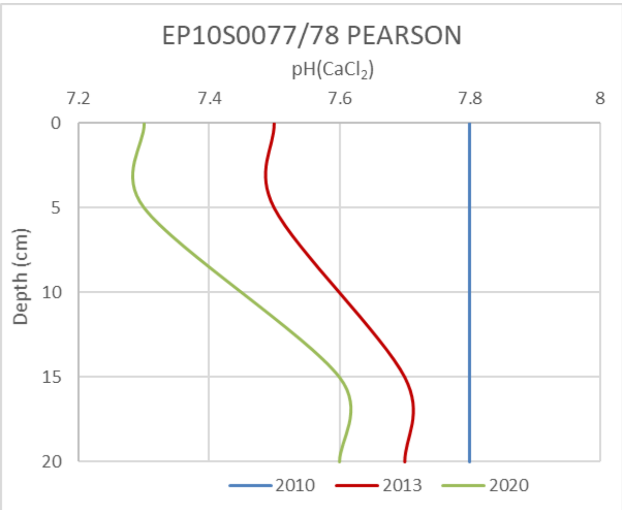
5.2.8 EP10M0015A/B KOCH (LAUBE), CUMMINS

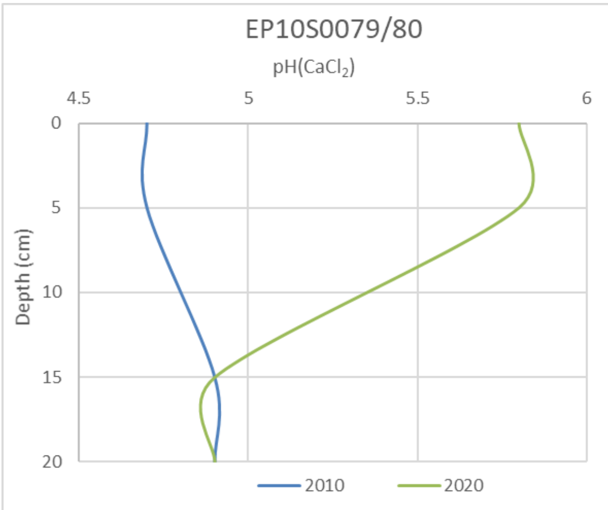




5.2.9 EP10S0067/68 HOLMAN, COCKALEECHIE

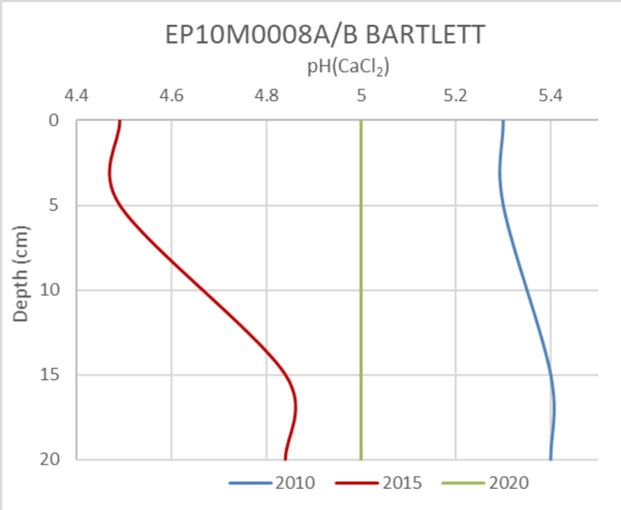
5.2.10 EP10S0069/70 HABNER (BAMMANN), COCKALEECHIE



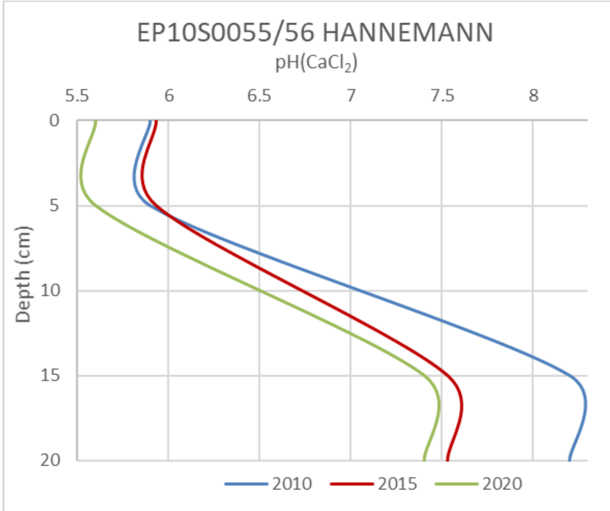


5.2.11 EP10S0077/78 PEARSON, YEELANNA

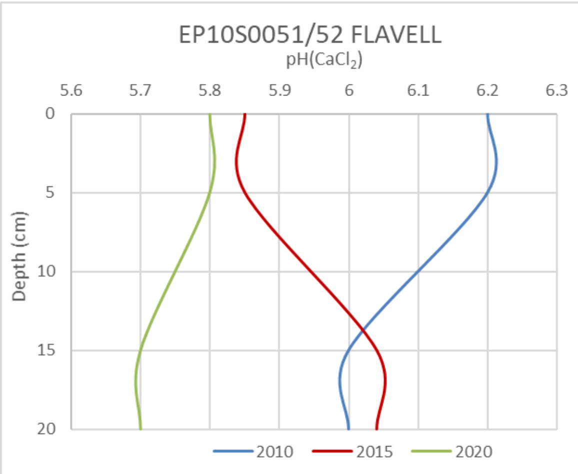
5.2.12 EP10S0079/80, STOKES



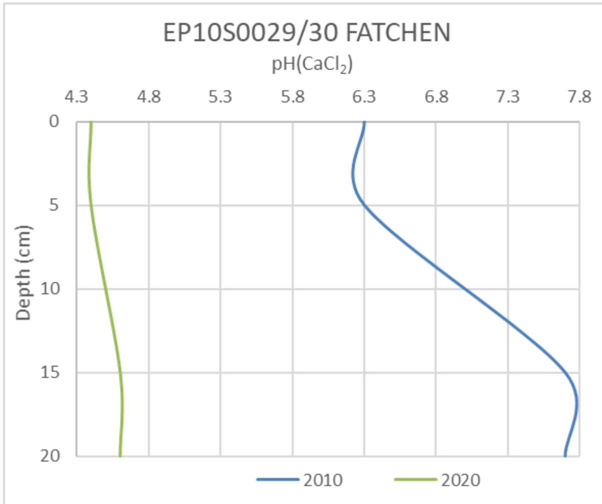
5.2.13 EP10M0008A/B BARTLETT, CAMPOONA



5.2.14 EP10S0055/56 HANNEMANN, CLEVE



5.2.15 5.2.15 EP10S0051/52 FLAVELL, CLEVE



5.2.16 EP10S0029/30 FATCHEN, UNGARRA

5.3 2020 SOIL NUTRITION

Sample ID	Organic Carbon (%)		EC 1:5	dS/m	Colwell P	mg/kg
SITE ID	0-10	10-20	0-10	10-20	0-10	10-20
EP10M0002A	2.7	0.9	0.097	0.034	69	34
EP10S0043	1.4	0.6	0.108	0.024	58	22
EP10S0031	1.0	0.3	0.081	0.023	29	31
EP10S0033	1.7	0.6	0.201	0.04	95	38
EP10S0037	1.7	1.0	0.154	0.229	61	<14
EP15B00KOPPIO3A	1.7	0.9	0.1	0.039	36	12
EP10M011	1.0	0.5	0.062	0.027	39	12
EP10M015	1.4	0.4	0.078	0.028	60	18
EP10S0067	<0.2	0.5	0.203	0.308	59	<14
EP10S0069	1.1	0.7	0.094	0.061	81	45
EP10S0077	1.8	0.9	0.182	0.174	28	<14
EP10S0079	1.5	0.6	0.075	0.028	26	16
EP10M0008B	1.5	0.5	0.146	0.076	45	<14
EP10S0051	0.8	0.3	0.148	0.051	29	33
EP10S0055	1.9	0.6	0.283	0.334	81	<14
EP10S0029	0.9	0.3	0.061	0.03	24	17

5.4 2020 EMERGING ACIDITY 'NEW' SURVEILLANCE SITES

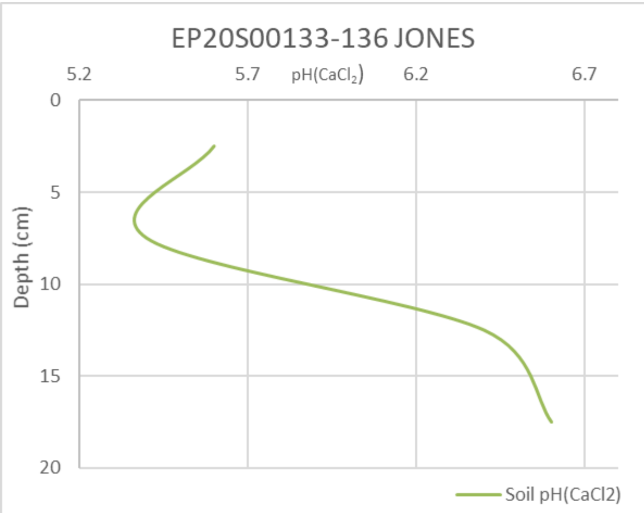
NREP2020 EMERGING SITE	SITE ID	NAME	LOCATION	GDA 94 MGA ZONE	EASTING	NORTHING
1	EP20S00133-136	JONES	WHARMINDA	53H	616525	6245209
2	EP20S00137-140	MASTERS	WHARMINDA	53H	619148	6244907
3	EP20S0141-144	FATCHEN	MOODY	53H	594799	6228688
4	EP20S0145-148	MODRA	MOODY	53H	589490	6238260
5	EP20S0149-152	SNODGRASS	MOODY	53H	597267	6227680
6	EP20S0153-156	CAMERON	MT HILL	53H	609567	6235145
7	EP20S0157-160	PRIME	WHARMINDA	53H	608397	6237749
8	EP20S0161-164	HUNT	WHARMINDA	53H	623838	6238586
9	EP20S0165-168	KITSON	WHARMINDA	53H	609072	6246706
10	EP20S0169-172	CAMERON	MT HILL	53H	610832	6234824

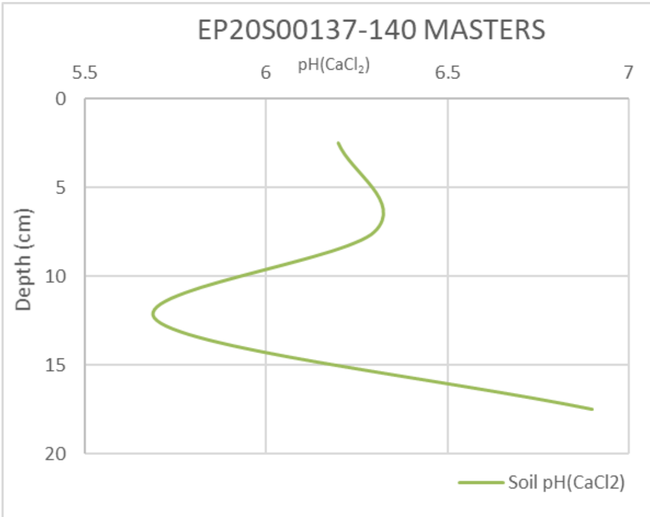
5.5 2020 EMERGING ACIDITY SURVEILLANCE PH RESULTS

SITE_ID	SAMPLE ID	LOCATION	SAMPLE DEPTH (cm)	Soil EC(1:5)	Soil pH(CaCl2)	Extract. Al (CaCl2) (mg/kg)
EP20S0133-136	EP10S00133	WHARMINDA	0-5	0.066	5.6	0.1
EP20S0133-136	EP10S00134	WHARMINDA	5-10	0.055	5.4	0.2
EP20S0133-136	EP10S00135	WHARMINDA	10-15	0.049	6.4	<0.1
EP20S0133-136	EP10S00136	WHARMINDA	15-20	0.038	6.6	<0.1
EP20S0137-140	EP10S00137	WHARMINDA	0-5	0.151	6.2	0.1
EP20S0137-140	EP10S00138	WHARMINDA	5-10	0.14	6.3	0.2
EP20S0137-140	EP10S00139	WHARMINDA	10-15	0.055	5.7	0.1
EP20S0137-140	EP10S00140	WHARMINDA	15-20	0.2	6.9	<0.1
EP20S0141-144	EP10S00141	MOODY CENTRE	0-5	0.177	4.5	1.4
EP20S0141-144	EP10S00142	MOODY CENTRE	5-10	0.116	4.3	2.3
EP20S0141-144	EP10S00143	MOODY CENTRE	10-15	0.032	4.3	1.7
EP20S0141-144	EP10S00144	MOODY CENTRE	15-20	0.15	5.7	<0.1
EP20S0145-148	EP10S00145	MOODY CENTRE	0-5	0.038	4.9	0.3
EP20S0145-148	EP10S00146	MOODY CENTRE	5-10	0.019	4.8	<0.1
EP20S0145-148	EP10S00147	MOODY CENTRE	10-15	0.015	4.5	0.6
EP20S0145-148	EP10S00148	MOODY CENTRE	15-20	0.013	4.5	0.9
EP20S0149-152	EP10S00149	MOODY CENTRE	0-5	0.12	5.4	0.1
EP20S0149-152	EP10S00150	MOODY CENTRE	5-10	0.086	5.2	0.1
EP20S0149-152	EP10S00151	MOODY CENTRE	10-15	0.116	6.1	<0.1
EP20S0149-152	EP10S00152	MOODY CENTRE	15-20	0.182	6.8	<0.1
EP20S0153-156	EP10S00153	MT HILL	0-5	0.078	6.3	<0.1
EP20S0153-156	EP10S00154	MT HILL	5-10	0.076	6.2	<0.1
EP20S0153-156	EP10S00155	MT HILL	10-15	0.039	6.8	<0.1
EP20S0153-156	EP10S00156	MT HILL	15-20	0.175	8	<0.1

EP20S0157-160	EP10S00157	WHARMINDA	0-5	0.189	5.7	0.2
EP20S0157-160	EP10S00158	WHARMINDA	5-10	0.092	5.6	0.2
EP20S0157-160	EP10S00159	WHARMINDA	10-15	0.193	7.3	<0.1
EP20S0157-160	EP10S00160	WHARMINDA	15-20	0.201	7.7	<0.1
EP20S0161-164	EP10S00161	WHARMINDA	0-5	0.105	6.5	<0.1
EP20S0161-164	EP10S00162	WHARMINDA	5-10	0.155	6.2	<0.1
EP20S0161-164	EP10S00163	WHARMINDA	10-15	0.05	6.9	<0.1
EP20S0161-164	EP10S00164	WHARMINDA	15-20	0.052	7.5	<0.1
EP20S0165-168	EP10S00165	WHARMINDA	0-5	0.082	6	0.1
EP20S0165-168	EP10S00166	WHARMINDA	5-10	0.072	5.3	0.2
EP20S0165-168	EP10S00167	WHARMINDA	10-15	0.046	5.1	0.4
EP20S0165-168	EP10S00168	WHARMINDA	15-20	0.03	5.1	0.3
EP20S0169-172	EP10S00169	MT HILL	0-5	0.201	6.2	<0.1
EP20S0169-172	EP10S00170	MT HILL	5-10	0.17	6.4	<0.1
EP20S0169-172	EP10S00171	MT HILL	10-15	0.118	7.7	<0.1
EP20S0169-172	EP10S00172	MT HILL	15-20	0.14	7.7	<0.1

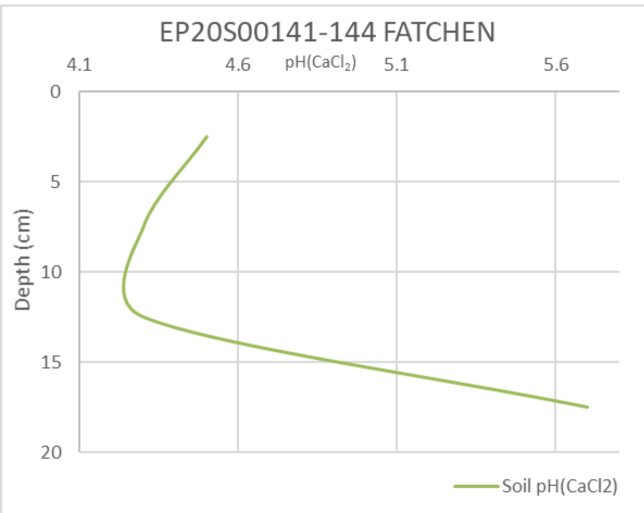
5.6 EMERGING SOIL PH PROFILE CHARTS

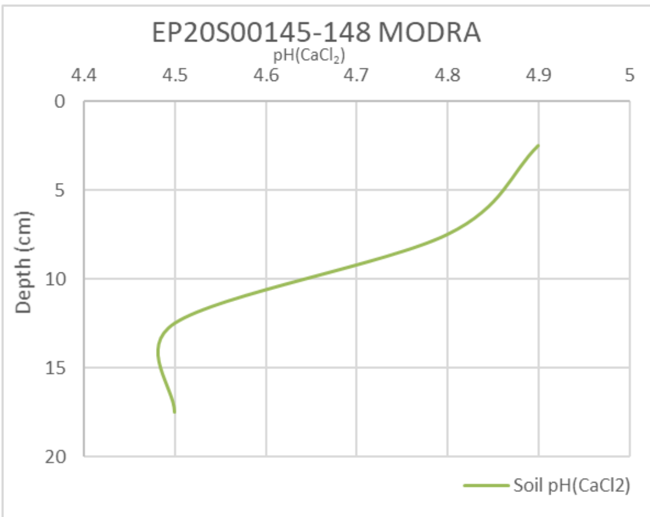




5.5.1 EP20S00133-136 JONES, WHARMINDA

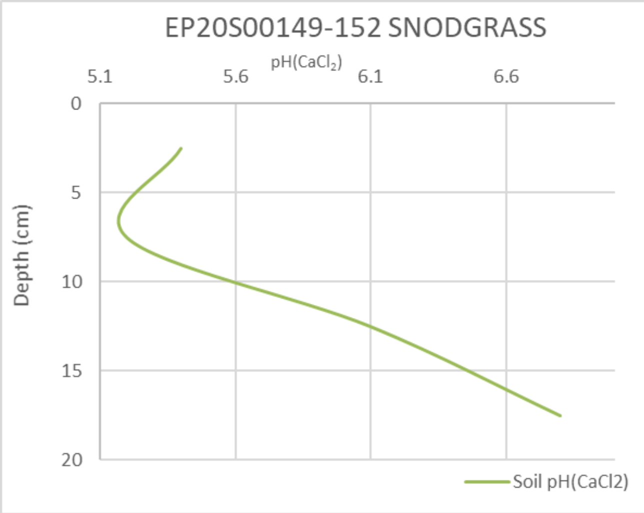
5.5.2 EP20S00137-140 MASTERS, WHARMINDA



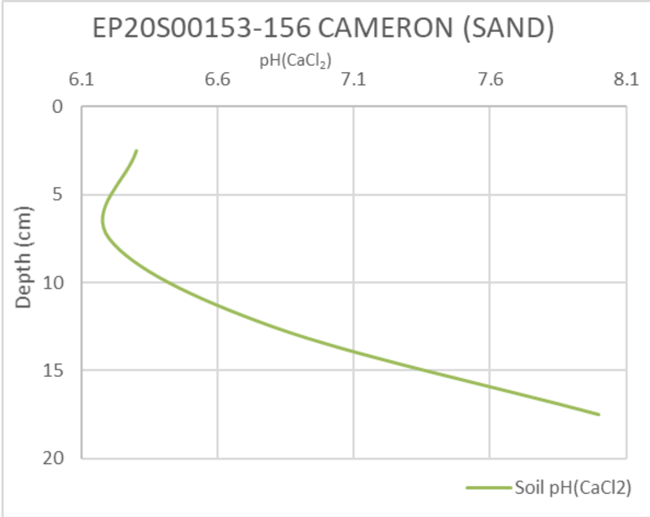


5.5.3 EP20S00141-144 FATCHEN, MOODY CENTRE

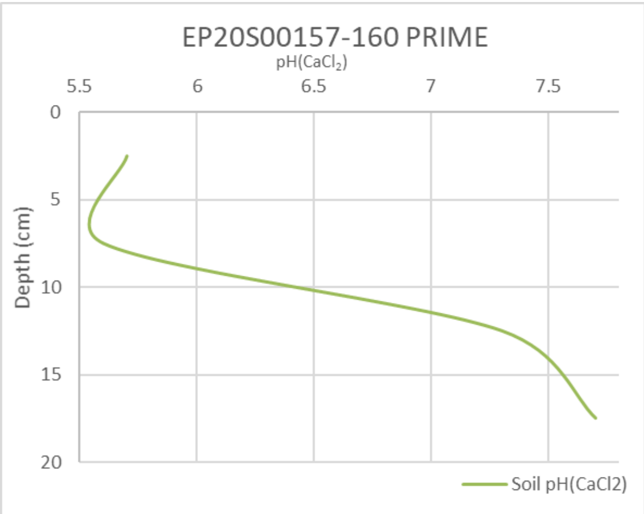
5.5.4 EP20S00145-148 MODRA, MOODY CENTRE



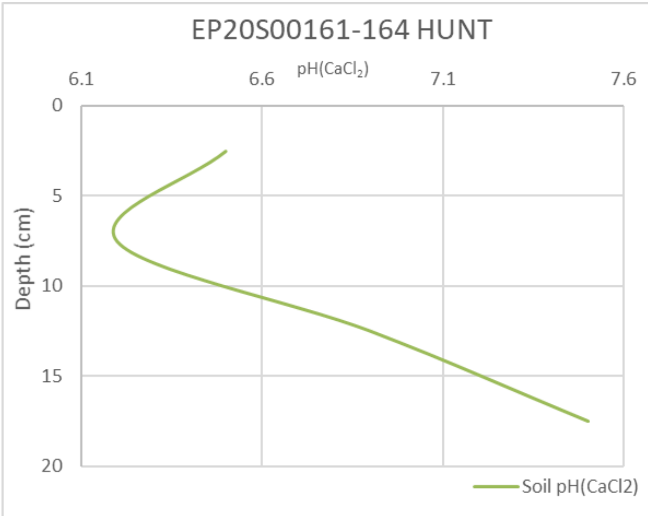
5.5.5 EP20S00149-152 SNODGRASS, MOODY CENTRE



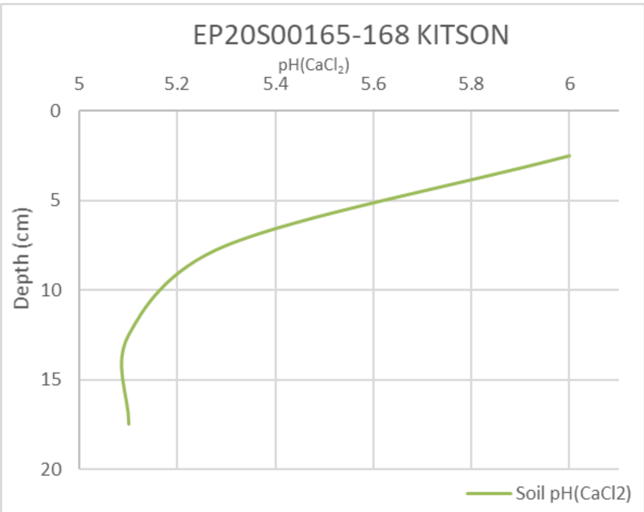
5.5.6 EP20S00153-156 CAMERON (SAND), MT HILL



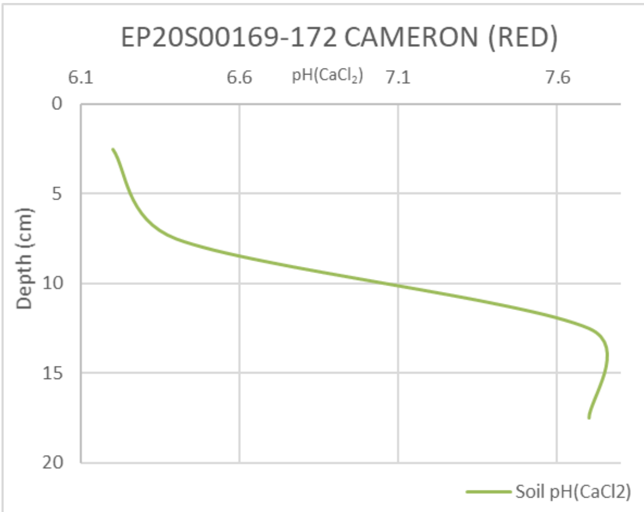
5.5.7 EP20S00157-160 PRIME, WHARMINDA



5.5.8 EP20S00161-164 HUNT, WHARMINDA



5.5.9 EP20S00165-168 KITSON, WHARMINDA



5.5.10 EP20S00169-172 CAMERON (RED), MT HILL

5.7 SOIL ORGANIC CARBON AND COLWELL P RESULTS

SITE ID	NAME	LOCATION	DEPTH	Soil Colwell P (mg/kg)	Soil Organic Carbon W&B (%)
EP20S00133-136	JONES	WHARMINDA	0-10	19	0.9
EP20S00133-136	JONES	WHARMINDA	10-20	11	0.2
EP20S00137-140	MASTERS	WHARMINDA	0-10	26	0.7
EP20S00137-140	MASTERS	WHARMINDA	10-20	<14	0.3
EP20S00141-144	FATCHEN	MOODY CENTRE	0-10	22	1.1
EP20S00141-144	FATCHEN	MOODY CENTRE	10-20	18	0.7
EP20S00145-148	MODRA	MOODY CENTRE	0-10	24	0.3
EP20S00145-148	MODRA	MOODY CENTRE	10-20	20	0.2
EP20S00149-152	SNODGRASS	MOODY CENTRE	0-10	30	1.3
EP20S00149-152	SNODGRASS	MOODY CENTRE	10-20	18	0.5
EP20S00153-156	CAMERON	MT HILL	0-10	13	0.8
EP20S00153-156	CAMERON	MT HILL	10-20	<14	0.2
EP20S00157-160	PRIME	WHARMINDA	0-10	28	1.0
EP20S00157-160	PRIME	WHARMINDA	10-20	<14	0.6
EP20S00161-164	HUNT	WHARMINDA	0-10	18	0.8
EP20S00161-164	HUNT	WHARMINDA	10-20	<14	0.2
EP20S00165-168	KITSON	WHARMINDA	0-10	27	1.1
EP20S00165-168	KITSON	WHARMINDA	10-20	23	0.3
EP20S00169-172	CAMERON	MT HILL	0-10	24	1.0
EP20S00169-172	CAMERON	MT HILL	10-20	<14	0.3

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