Gloucester Stage 1A Irrigation Trial

Summary Report 2
(Soil and cropping activities from 1st September 2013 to 31 March 2014)

Tiedman Irrigation Program

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for AGL Upstream Investments Pty Ltd

9 May 2014

Table of Contents

1. Introduction

AGL Upstream Investments Pty Ltd (AGL) engaged Fodder King Ltd (FK) to provide technical advisory services with the site evaluation, design, set-up and operation of the Tiedmans irrigation program for the Gloucester Gas Project (GGP). The irrigation program involves two irrigation areas - the Stage 1A and Stage 1B areas. These areas are shown in Figure 1.

The Stage 1A area is the major focus of the irrigation program and this second summary report. This area is undergoing intensive monitoring of soil, water and crops, and irrigation (after blending) of most of the produced water stored on Tiedmans from previous pilot testing programs. This report follows the format of the earlier summary report (FK, 2013c) but also includes additional information on the nutrient and mineral content of the crops that have been planted and harvested across the Stage 1A area over the last 7 months.

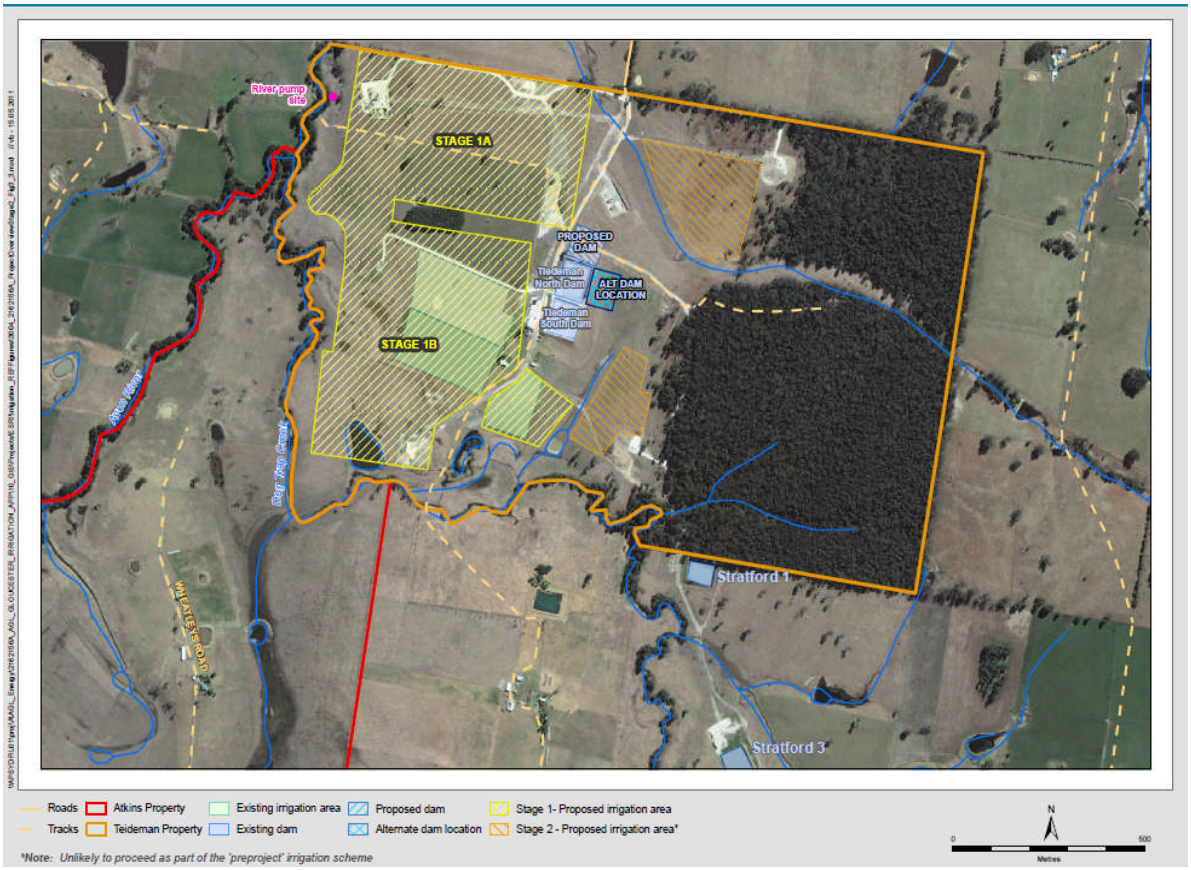

Figure 1: Gloucester Irrigation Areas for Exploration Produced Water

1.1. Background

AGL has a commitment to leave behind an improved agricultural landscape with improved soils that can be used for pasture and cropping. Cropping activities are not common in the district due to poor native soils and the lack of success with cropping on the valley side slopes. Most irrigation of crops and pasture in the local area is on the alluvial floodplain where the soils tend to be deeper and more fertile.

The high rainfall produces a green hue across the area that serves to disguise the infertile nature of the parent soils on the valley side slopes and their low water-holding capacity.

The Stage 1A area is located off the alluvial floodplain on AGL's Tiedmans property and is about 22 hectares (ha) in total, of which 12 ha is irrigated. Annual crop types planted and harvested to date have been triticale (winter 2013) and forage sorghum (summer 2013/14). Lucerne is also planted in alternate plots as a perennial fodder crop. Triticale was planted in late March 2013 and the last harvest was late September 2013. There was one cut of the triticale during the period of this report. The forage sorghum was planted in the former triticale plots in late September 2013 and the last harvest was late April 2014. There were three cuts of the forage sorghum during the period. The lucerne was planted in early April 2013 and continues to develop. There were five cuts of the lucerne during the period.

There are 16 equal-sized trial plots in the Stage 1A area. Each individual plot is approximately 0.75 ha. There are four soil treatment types (slots to different depths) being evaluated in combination with the two different crop systems. Full details are provided in FK, 2014.

Soil improvements were completed in January 2013 prior to any irrigation occurring. No further soil treatment is proposed as part of the current trial.

In the 6 months from 1 July to 31 December 2013, 32.45 megalitres (ML) of blended irrigation water was applied to the trial area (FK, 2014). An additional 18.31 ML were applied from 1 January to 31 March 2014. For the 7 month period 1 September 2013 to 31 March 2014, 44.62 ML was applied to irrigate the alternate plots of lucerne and forage sorghum. Assuming an average salinity of 1200 mg/L Total Dissolved Solids (TDS) (~1500 EC), this equates to 53.5 tonnes of salt applied in the blended water for this 7 month reporting period.

1.2. Purpose and scope of the Stage 1A trial

The primary purpose of the trial is to assess whether diluted produced water is a suitable reuse method on the improved soils, at reasonably high application rates, using salt-tolerant annual and perennial fodder species. It uses stored produced water from AGL's exploration activities so as to develop the knowledge and data for a sustainable beneficial-reuse strategy for the full-scale GGP.

A secondary purpose of this trial is to demonstrate AGL's commitment to leaving behind, on completion of the GGP, the legacy of an improved agricultural landscape with more productive soils than the original low quality parent soils. This should enable more productive agricultural use by subsequent owners or operators of the project land.

The trial involves the addition and mixing of ameliorants with the parent soils, the application of blended water (produced water and fresh water) to those soils with the aid of an accurate irrigation system, the regular sampling and testing of the soils, the regular analysis of mass and water balances, and analysis and reporting on the results.

1.3. Purpose and scope of this report

The purpose of this summary report is to report on the soil and crop attributes of the Stage 1A irrigation area (and to discuss any emerging trends) for the 7 month irrigation period from 1 September 2013 to 31 March 2014.

The scope of the report is to summarise the nutritional and mineral content data and information which is in addition to AGL's compliance monitoring reports to DRE for every 6 months that the irrigation program is in operation.

This report also draws on information from previous soil assessment reports:

- Baseline 2 – amended soil sampling report (after installation and prior to irrigation) (FK, 2013a);
- Baseline 3 – soil sampling report (after initial irrigation period) (FK, 2013b);
- Baseline 4 – soil sampling report (after 6 months of irrigation from 1 July to 31 December 2013) (FK, 2014);

and previous water assessment reports:

- Water sampling report for the 6 months for irrigation from 1 July to 31 December 2013 (PB, 2014).

The report has also been released at this time to address the concerns of the community that the silage produced may be 'contaminated' and that the salts in the produced water may accumulate in the harvested crops and possibly impact on animal health and affect the suitability of their products for human consumption.

2. Soil monitoring

The soil information in this summary report is from the sampling program completed in November 2013.

2.1. Key soil quality findings - Baseline 4 (November 2013) vs Baseline 3 (May 2013)

Soil samples are taken at the same locations for every sampling event. Samples are analysed for a range of soil parameters as described in FK, 2014.

When the soil test data is received, four data analyses are carried out: Averages, Maxima, Minima and Standard Deviations. The following discussion relates to analysis of the average values.

Salinity (as Electrical Conductivity)

As discussed in FK 2014, the Baseline 4 (November 13) soil data indicates minimal changes in salinity (Ec) compared to the Baseline 3 results (May 13). However at one site (CS3 in the soil treatment area with the deepest slots) an increase in salinity was observed to a depth of 100cm.

Soil Nitrate

The decrease in nitrate values reflects its high level of mobility in the soil when water (as irrigation or rainfall) is applied. The decrease can also be explained by the high level of uptake by the plants, facilitated by an optimum level of soil ECEC (effective cation exchange capacity).

Exchangeable Sodium and Exchangeable Sodium Percentage (ESP)

Exchangeable sodium has slightly increased at all depths. As a result the exchangeable sodium percentages have also increased and were marginally above the desirable level of 6% or lower. No deleterious effects on crops has been observed.

Soil pH

Soil pH of the ameliorated soil is within the optimal range. The soil pH values are tending to acidic at depth. The effect of higher pH (alkaline) water on the slightly acidic soil at depth, as reported previously, has resulted in benefical increases to soil pH.

Organic Carbon

Organic Carbon levels are within the optimal range.

Effective Cation Exchange Capacity (ECEC)

ECEC is generally within the desired range.

Water holding capacity (WHC)

The water holding capacity (WHC) of the ameliorated soil has improved substantially in comparison to the parent soils and thus makes the ameliorated soils more suitable for cropping. Soil moisture monitoring confirms that rainfall and/or irrigation is reaching the full treatment depth in all plots.

Saturated hydraulic conductivity (SHC)

Saturated hydraulic conductivity (SHC) is a laboratory test carried out on soil samples to determine their relative ability to allow water to move through the soil. The parent soils had a SHC value of 0.11 mm/hr which is very low but typical of the poor soil types of the area and is a factor in making them unsuitable for cropping. Baseline 2 soil sampling included the measurement of SHC of the ameliorated soils which was determined to be 3.28 mm/hr, which is a substantial improvement of about 30 times. Baseline 5 soil testing to be done in May/June 2014 will re-measure SHC.

Soil Structure

Soil structure is being maintained (minimising dispersion and promoting infiltration) by monitoring the temporal relationship between soil sodicity (as ESP) and the electrolyte concentration of the irrigated blended water (as SAR). Soil ESP in Baseline 4 increased at all depths compared to Baseline 3 however the SAR of applied waters remained above dispersion thresholds.

3. Crop Performance

Two separate fodder testing programs are being undertaken for the trial. Firstly, fresh cut crop samples are being collected just prior to harvesting to form a 'snapshot' of what the plants have taken up nutritionally, as well as measuring a range of minerals and salts to aid in mass balance analysis.

The second set of samples is also being collected for nutritional analysis of the harvested product to enable benchmarking against industry feed databases.

Nutritional tests are taken after the hay or silage has been made and when it is ready for consumption to match the industry database. Use of fresh cut samples would be inappropriate for nutritional tests as there is normally some loss of dry matter and nutrition during harvesting. Both the fresh cut and silage/hay laboratory results for the period are provided in Attachment 1.

3.1. Crops and harvesting

For the winter 2013 annual crop (triticale), there was one harvest which resulted in nine bales of silage (2.49 tonnes on a Dry Matter (DM) basis) during the period. Triticale was replaced by forage sorghum in late September 2013.

Lucerne is a winter dormant crop and did not begin to become active until after June when evapotranspiration values and warmer weather commenced.

In the reporting period, the Lucerne was harvested five times and resulted in 91 bales of hay and silage (29.71 tonnes DM) while the Forage Sorghum was harvested three times and resulted in 142 bales of hay and silage (28.05 tonnes DM).

Information in this second summary report mostly focuses on performance of the forage sorghum and the lucerne over the last 7 months from 1 September 2013 to 31 March 2014.

3.2. Definition of nutritional measures

The nutritional test results are provided in Attachment 1. When testing crops for nutritional value there are a relatively small number of parameters to evaluate their animal-feeding-quality and they are:

- Dry Matter (DM%)
- Dry Matter Digestibility (DMD%)
- Dry Organic Matter Digestibility (DOMD%)
- Metabolisable energy (ME as mj/kg of Dry Matter)
- Crude protein (CP% of Dry Matter)
- Neutral Detergent Fibre (NDF%)
- Acid Detergent Fibre (NDF%)

These terms are defined in the Terms and Abbreviations section of this report.

3.3. Comparison of hay and silage quality with national quality grading standards

Tables 3.1 and 3.2 set out the relevant Australian Fodder Industry Association (AFIA) national grading standards for lucerne and cereals respectively, while Table 3.3 summarises the quality grading achieved for each harvest ("cut") up to the end of March 2014.

Table 3.1: Lucerne Hay and Silage Quality Grading System

AFIA Grades for Legume and Pasture Hay & Silage					
Dry Matter Digestibility (%DM)	**Metabolisable Energy (Mj/kg DM)**	**Crude Protein (% DM)**			
		>19	**14-19**	**8-13**	**<8**
>66	**>9.5**	A1	A2	A3	A4
60-66	**8.7-9.5**	B1	B2	B3	B4
53-59	**7.4-8.4**	C1	C2	C3	C4
<53	**<7.4**	D1	D2	D3	D4

Table 3.2: Cereal Hay and Silage Quality Grading System

AFIA Grades for Cereal Hay & Silage					
Dry Matter Digestibility (%DM)	**Metabolisable Energy (Mj/kg DM)**	**Crude Protein (% DM)**			
		>10	**8-10**	**4-7**	**<4**
>66	**>9.5**	A1	A2	A3	A4
60-66	**8.7-9.5**	B1	B2	B3	B4
53-59	**7.4-8.4**	C1	C2	C3	C4
<53	**<7.4**	D1	D2	D3	D4

Table 3.3: Summarised Harvest Quality Gradings

Crop	**Harvested Quality Grading achieved**				
Triticale	Triticale Silage Cut 2 (23/9/13)				
Grade	A1				
Forage Sorghum	Forage Sorghum Silage Cut 1 (31/1/14)	Forage Sorghum Hay Cut 2 (31/1/14)	Forage Sorghum Silage Cut 3 (tba)		
Grade	A2/B2	A1	N/A		
Lucerne	Lucerne Silage Cut 2 (23/9/13)	Lucerne Hay Cut 3 (23/12/13)	Lucerne Hay Cut 4 (31/12/13)	Lucerne Hay Cut 5 (31/1/14)	Lucerne Silage Cut 6 (tba)
Grade	A1	A1	A1	A1	N/A

Note: "N/A" denotes results not available yet; Dates are 'as received' at the laboratory dates; tba – to be advised

It is clear that the quality of the harvested fodder produced in the period has been very good with grades for all cuts (except for the forage sorghum) assessed as A1. The nutritional results of the harvested product show no signs of degradation from the applied blended irrigation water.

3.4. Benchmarking analysis

There are no national aggregated statistical analyses for forage-based feeds that have been produced and tested in Australia. However, the laboratory selected to carry out the feed analysis has a relatively large database of test results for Australian-produced feeds. Historical results from the FeedTest laboratory for the past 8 years have been provided and analysed.

The analyses discussed below are based on representative samples taken from harvested hay and silage. In the case of hay, the samples are taken within a week of harvesting while the silage samples are taken approximately five weeks after harvesting to allow natural anaerobic processes to occur.

In reading the following tables it should be noted that high decile rankings for Crude Protein, Dry Matter Digestibility and Metabolisable Energy are desirable. In contrast, for Neutral Detergent Fibre, low decile rankings are desirable.

Triticale Silage

While Triticale silage is not common, for the purpose of analysis it was classified as a Cereal silage and there were 1260 samples in the Cereal silage database.

Table 3.4 compares the Cut 2 results against the mean of all the samples in the cereal silage database, and provides the decile ranking for these results.

Cut 2 was considerably better than Cut 1 (see FK, 2013c) with Crude Protein, Dry Matter Digestibilty and Metabolisable Energy all in Decile 7 compared to the previous Decile 4, 5, and 5 respectively for Cut 1.

Typically, for a crop like triticale, Neutral Detergent Fibre is quite high - in Decile 6 for Cut 2 (versus Decile 8 for Cut 1).

Table 3.4: Triticale Silage Comparisons

Tiedmans Triticale silage Cut 2 vs all Cereal silage				
Item	**Crude Protein (%DM)**	**Dry Matter Digestibility (%DM)**	**Metabolisable Energy (mj/kg DM)**	**Neutral Detergent Fibre (%DM)**
Feedtest Database Mean (1260 samples)	11.9	66.8	10.1	52.9
Tiedmans Cut 2 (Sample No. 11) Sample Mean	17.6	67.9	10.3	57.8
Decile Ranking	7	7	7	6

Forage Sorghum Hay and Silage

In the reporting period there were two cuts of silage (Cuts 1 and 3) and one cut of hay (Cut 2). While Forage Sorghum hay and silage is not common, for the purpose of analysis it was classified as a Cereal silage and there were 1260 samples in the Cereal silage database

Table 3.5 compares the Cut 1, 2 and 3 results against the mean of all the samples in the cereal silage database, and provides the decile ranking for these results. Due to the delay period required before sampling and testing forage sorghum Cut 3 (silage) was not available at the time of issue of this report.

For the first cut Crude Protein was in Decile 3, Dry Matter Digestibility was in Decile 7, Metabolisable energy was in Decile 5 and Neutral Detergent Fibre was in Decile 7. These are low figures but results still place this type of feed in the A2/B2 grading level as shown in Table 3.2. Cut 2 had improved Crude Protein and Dry Matter Digestibility and is in the A1 grading category.

Table 3.5: Forage Sorghum Hay and Silage Comparisons

Tiedmans Forage Sorghum silage Cuts vs all Cereal silage				
Item	**Crude Protein (%DM)**	**Dry Matter Digestibility (%DM)**	**Metabolisable Energy (mj/kg DM)**	**Neutral Detergent Fibre (%DM)**
Feedtest Database Mean (1260 samples)	11.9	66.8	10.1	52.9
Tiedmans Cut 1 Sample No. 20 Sample Mean	9.3	64.1	9.8	67.8
Decile Ranking	3	7	5	7
Tiedmans Cut 2 Sample No. 21 Sample Mean	11.8	66.9	9.9	63.0
Decile Ranking	3	7	5	7
Tiedmans Cut 3 Sample No. N/A Sample Mean	N/A	N/A	N/A	N/A
Decile Ranking	N/A	N/A	N/A	N/A

Note: "N/A" denotes results not available yet

Lucerne Silage

Lucerne silage is classified under Legume hay and silage and there were 894 samples in the Legume silage database. These results compared favourably with the rest of the database with Crude Protein being greater than 60% of all samples (Decile 6) for Cut 1 and 90% (Decile 9) for Cut 2.

Table 3.6 compares the Cut 2 and 6 results against the mean of all the samples in the legume silage database, and provides the decile ranking for these results. . Due to the delay period required before sampling and testing lucerne Cut 6 (silage), results were not available at the time of issue of this report.

Dry Matter Digestibility was greater than 70% for Cut 2.

Metabolisable Energy was greater than 70% for Cut 2.

Neutral Detergent Fibre was Decile 4 for Cut 2.

Table 3.6: Lucerne Silage Comparisons

Tiedmans Lucerne silage Cuts vs all Legume silage				
Item	**Crude Protein (%DM)**	**Dry Matter Digestibility (%DM)**	**Metabolisable Energy (mj/kg DM)**	**Neutral Detergent Fibre (%DM)**
Feedtest Database Mean (894 samples)	20.8	67.4	10.2	40.9
Tiedmans Cut 2 Sample No.12 Sample Mean	27.3	71.2	10.7	38.1
Decile Ranking	9	7	7	4
Tiedmans Cut 6 Sample No.N/A Sample Mean	N/A	N/A	N/A	N/A
Decile Ranking	N/A	N/A	N/A	N/A

Note: "N/A" denotes results not available yet

Lucerne Hay

Lucerne hay is classified under Legume hay and there were 4428 samples in this database.

Table 3.7 compares the Cut 3, 4, 5 results against the mean of all the samples in the lucerne hay database, and provides the decile ranking for these results.

Table 3.7: Lucerne Hay Comparisons

Tiedmans Lucerne hay Cuts vs all Lucerne hay				
Item	**Crude Protein (%DM)**	**Dry Matter Digestibility (%DM)**	**Metabolisable Energy (mj/kg DM)**	**Neutral Detergent Fibre (%DM)**
Feedtest Database Mean (4428 samples)	20.3	64.9	9.5	42.4
Tiedmans Cut 3 Sample No. 13 Sample Mean	26.3	71.0	10.6	37.2
Decile Ranking	9	8	8	3
Tiedmans Cut 4 Sample No. 17 Sample Mean	20.8	67.9	10.1	37.4
Decile Ranking	7	8	8	3
Tiedmans Cut 5 Sample No. 22 Sample Mean	25.0	66.0	9.7	39.4
Decile Ranking	8	7	7	3

Generally these results compared favourably with the rest of the database with Crude Protein being greater than 90% of all samples (Decile 9) for Cut 3, 70% (Decile 7) for Cut 4 and 80% (Decile 8) for Cut 5.

Dry Matter Digestibility was greater than 70% of all samples (Decile 7, 8) for all cuts.

Metabolisable Energy was greater than 70% of all samples (Decile 7, 8) for all cuts.

Neutral Detergent Fibre was at a desirable level in Decile 3 for all cuts, indicating that 70% of all samples had a higher NDF.

3.5. Salt and mineral take up

Participants in Australia's fodder industry are increasingly adopting , as normal practice, the type of nutritional testing and reporting outlined above. However at this stage it is most unusual to test for macro and micro mineral content, let alone test for trace elements. Nevertheless, for completeness, these tests and analysis of the results has been carried out for the crops grown as part of the Tiedmans irrigation trial.

There are over 60 inorganic elements or minerals found in soils, which are taken up by plants. Of those, 17 minerals have been found to be essential for animals. Essential minerals are required for maintenance, health, growth, reproduction, lactation and fattening of animals.

Those required in gram amounts per day are referred to as Macro Minerals and these include calcium, phosphorus, sodium, chlorine, potassium, magnesium and sulphur. Those minerals required in mg or less per day are called Trace Minerals and include cobalt, copper, chromium, fluorine, iodine, iron, manganese, molybdenum, selenium and zinc.

These essential minerals are salts derived from the soils and from rainfall and the water applied to irrigate crops and pasture. The soil profile is the major source of salt used by vegetation, pasture and crops. Rainfall and irrigation add salt to the soil, while harvested crops and pasture consumed by animals removes a percentage of that salt. In addition, some (near surface) salt naturally runs off in overland flow and is exported from the catchment by streams. If salinity is at depth in the soil profile it will leach (or percolate) below the root zone and eventually migrate through the weathered rock to reach the water table.

AGL's practice under the irrigation trial has been to monitor the salt balance (particularly to measure the uptake in crops and any accumulation in the soil profile), to ensure that no additional salt is exported through overland flow, to ensure there is no degradation of the soil profile, and to confirm that salt is leaching below the root zone and is migrating to the water table. The groundwater in the shallow rock is brackish to slightly salty and is not expected to be impacted by deep percolation beneath the irrigation area. Surface water and groundwater monitoring is in place to monitor for any changes in water levels or water quality (PB, 2014).

Representative fresh-cut samples of each crop were taken and analysed to monitor the mineral content, and the laboratory results for the period are provided in Attachment 1.

The minerals in the fodder crops are predominantly potassium (K) and chloride (Cl) (although for the lucerne, calcium (Ca) is also high making the predominant minerals in lucerne K-Ca-Cl). Amongst the trace and other minerals, iron (Fe), manganese (Mn), and aluminium (Al) are the most common in all crops. Boron (B), bromide (Br), strontium (Sr) and zinc (Zn) are present to a lesser extent and there are negligible concentrations of other metals (such as arsenic, cadmium, copper, lead, mercury, nickel, cobalt, selenium, molybdenum).

High K levels were noted in the compost introduced into the soil treatment and slotting program across the trial area in 2013. MNC Agronomy's opinion is that the compost is primarily the reason for the high uptake of K in the plants and it is expected that levels will decline over time (see MNC report in Attachment 2). Recent trend data for both forage sorghum and lucerne suggests that the K concentrations in fodder are on the decline.

AGL has also sampled the composted soils, parent soils and the presence of the trace minerals in fodder is similar to the underlying soils and weathered rock types (PB report in prep).

At this stage of the trial there is insufficient trend data to arrive at definitive conclusions as to possible changes in the concentration of salts and minerals in crops as a result of blended water irrigation. The available data suggests there is little variability between harvest sampling events over the last 12 months. The data shows that the macro minerals have the highest concentrations in all crop types, and the trace metals and other minerals have low or negligible concentrations. Trends for the macro minerals, and trace and other mineral content in each of Triticale, Forage Sorghum and Lucerne are shown in Figures 2ab, 3ab and 4ab respectively.

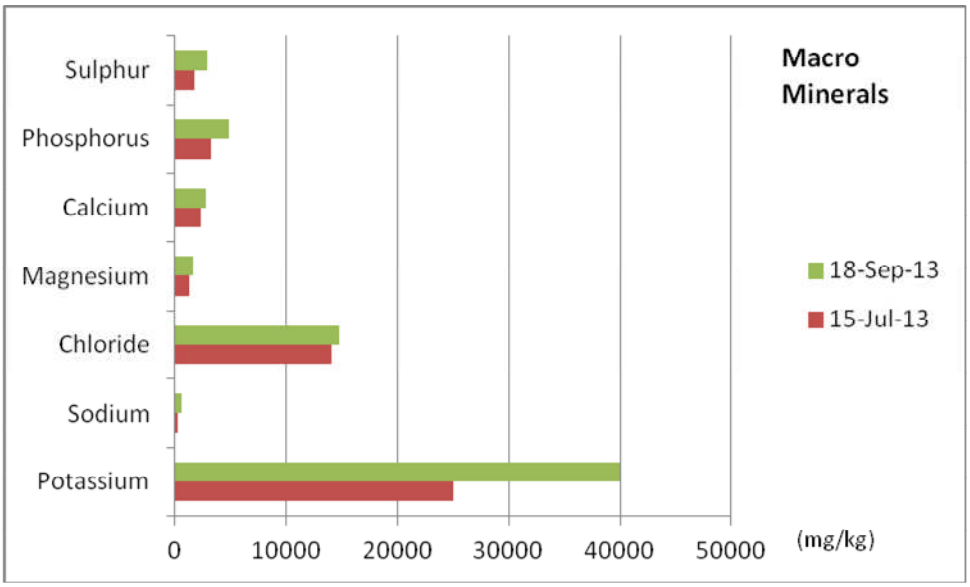

Figure 2a: Macro Ion Mineral Content in Triticale

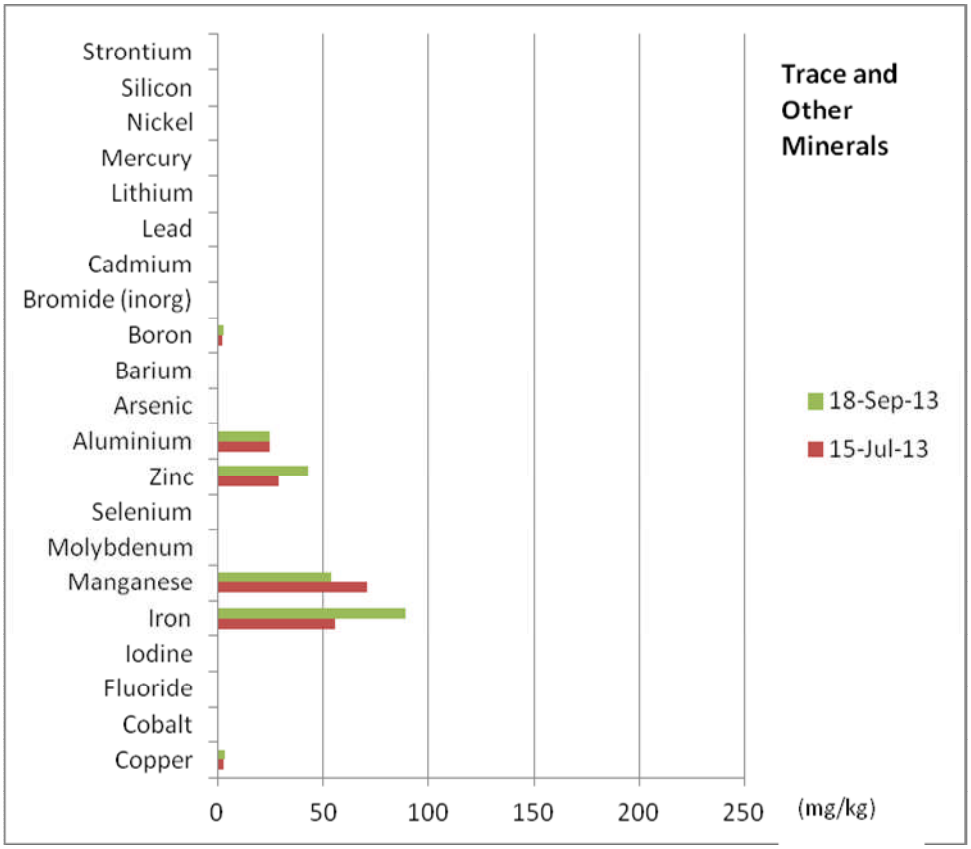

Figure 2b: Trace and Other Mineral Content in Triticale

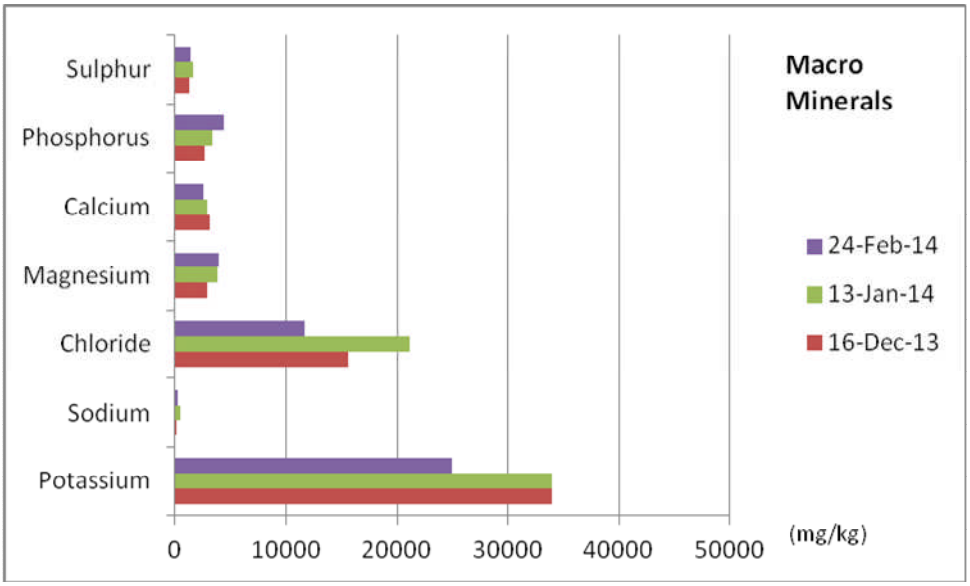

Figure 3a: Macro Ion Mineral Content in Forage Sorghum

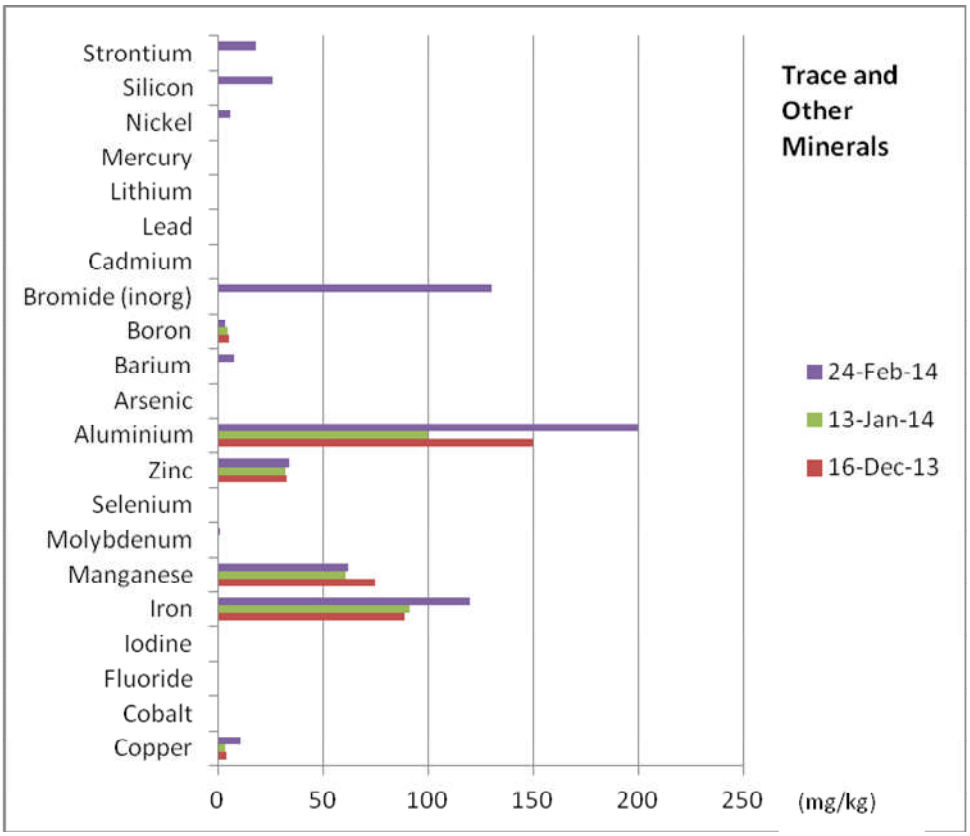

Figure 3b: Trace and Other Mineral Content in Forage Sorghum

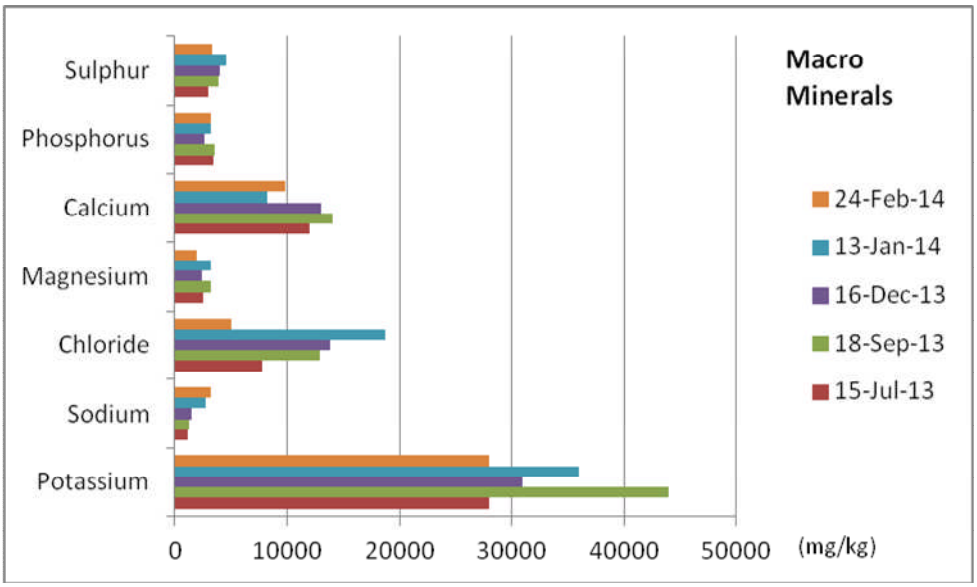

Figure 4a: Macro Ion Mineral Content in Lucerne

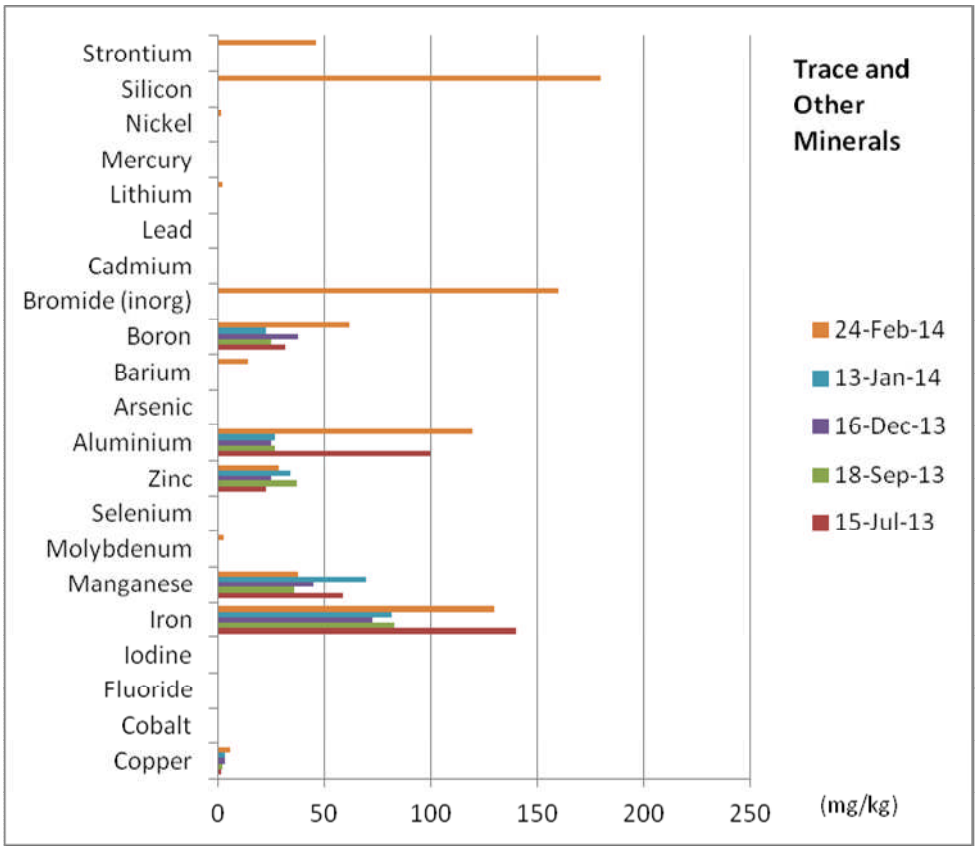

Figure 4b: Trace and Other Mineral Content in Lucerne

Based on two fresh-cut samples from the triticale, three fresh-cut samples from the forage sorghum and five fresh-cut samples from the lucerne, the salt take-up, as measured by chlorides, currently ranges between 1% and 2% on a dry matter basis, with an overall average of 1.36%. For a high yielding crop system producing about 30 tonnes DM/ha/year this equates to approximately 400 kg of chlorides/ha/year being extracted from the soil/water by crops. Further salt balance analysis will be undertaken and discussed at the conclusion of the trial.

Similar calculations can be made for the other minerals taken up by these crops but the individual tonnages are not presented here. For the 60.25 tonnes of DM produced during the 7 months from 1 September 2013 to 31 March 2014, the total salt content in all harvested crops was approximately 3600 kg (3.6 tonnes).

The irrigation water is predominantly sodium (Na)-chloride (Cl)-bicarbonate (HCO_3) with minor potassium (K). The blended water quality from May, August and November 2013 (PB, 2014) and February 2014 is shown in Figure 5ab in the same format as the mineral results for the fodder.

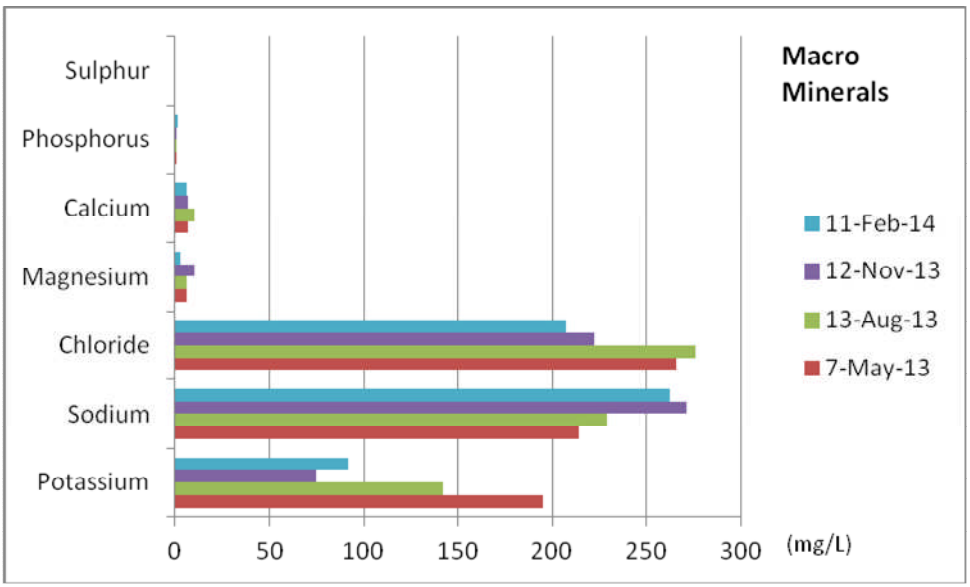

Figure 4a: Macro Ion Mineral Content in Blended Irrigation Water

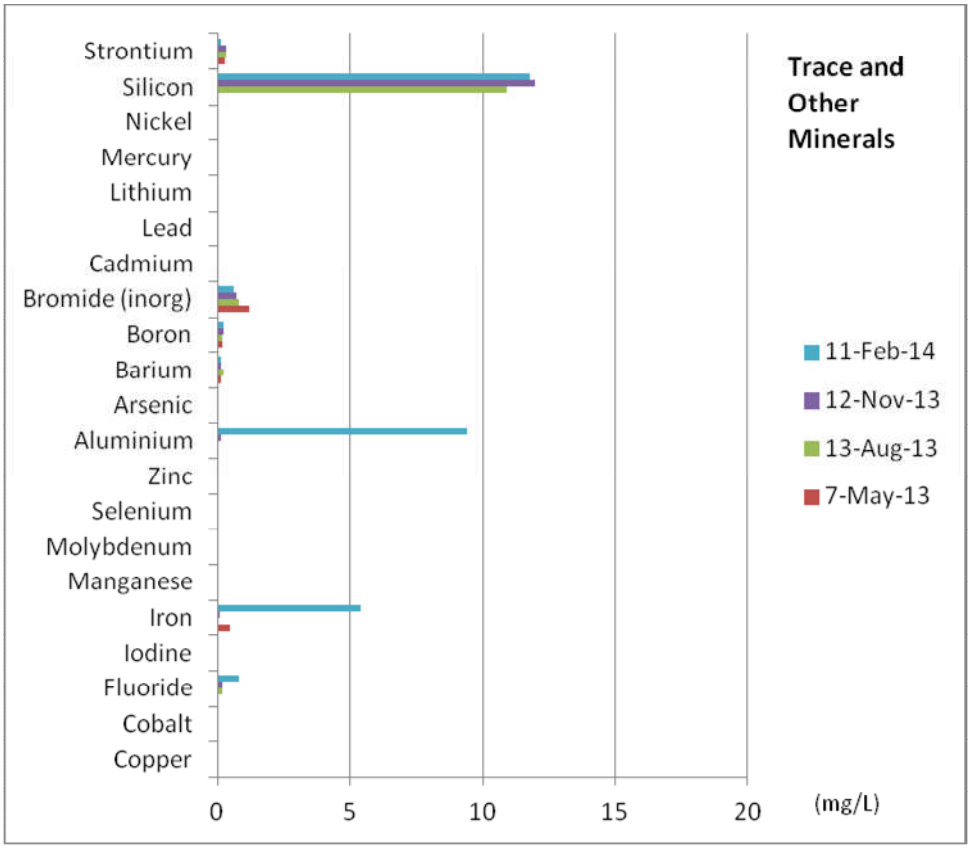

Figure 4b: Trace and Other Mineral Content in Blended Irrigation Water

The concentration of the macro ions in the irrigation water suggests some correlation with the fodder mineral results with high potassium and chloride in both. Similarly for trace and other metals there is some correlation with minor aluminium, bromide and iron in both. The blended water is compliant with the ANZECC guidelines for irrigation waters (PB, 2014).

There is insufficient trend data to conclude whether the compost, soil or blended water is contributing the most salt to the mineral content in the harvested crops. Continuation of the trial and the continued monitoring of the

mineral content in the fodder crops is recommended in combination with soil and blended water monitoring programs. In addition a literature review of published scientific papers may provide a greater insight into the mineral uptake of certain plant types and the proportional contribution from soils and water.

3.6. Feed toxicity to animals

A separate feed evaluation program to test for possible nutritional and health impacts in farm animals that may be fed on this hay and silage was initiated in early 2014. The specialist consultant report by ANCS is enclosed as Attachment 2. One representative fresh-cut sample of each crop type (Lucerne and Forage Sorghum) was taken prior to harvesting and tested for nutritional value, macro minerals, and trace minerals and a range of other minor minerals.

The level of detail undertaken for testing in this irrigation trial for macro minerals and trace and other minerals in fodder is unusual in Australia and there is no known reliable database to benchmark these results. Therefore the minerals tested were compared against the international standard, termed Maximum Tolerance Level (MTL's). MTL is defined as "the dietary level that when fed for a defined period will not impair animal health or performance and should not produce unsafe residues in human food derived from the animal". It is a level based on the assumption that the silage/hay is the only feed for the respective animal groups (which is not normally the case as silage and hay are usually fed as a supplement to pasture). The graphical representation of the MTLs and the various minerals for each crop type for cattle and sheep is shown in Attachment 2. The brief discussion below only relates to cattle as beef cattle grazing and dairying are the dominant agricultural practices in the Gloucester district. Other discussion for sheep is provided in Attachment 2.

The macro minerals and trace minerals results were acceptable. For Lucerne, potassium and sulphur were above 80% of the MTL (for cattle) and for the Forage Sorghum, potassium and magnesium were above 80% of the MTL (for cattle). In the Other Minerals category, bromide was above the 80% MTL (for cattle) for Lucerne whilst there were no trace or other minerals above 80% MTL (for cattle) for the Forage Sorghum.

A specialist opinion report by MNC Agronomy on the high potassium values (in Attachment 2) states that:

"Essentially, the high plant tissue K levels currently and previously observed are a function of a rapidly changing soil structure caused by a large amount of ameliorants being incorporated into a poorly structured soil in a small timeframe. The feedlot manure alone added in excess of 180kg/K/ha, and as this is a highly mobile cation, its availability was extremely high initially. As the soil structure changes settle over the coming months, the soil and plant tissue nutrient levels will balance themselves, and I expect plant tissue K levels will reduce significantly."

From an animal feeding perspective the consultant nutritionist (ANCS) has concluded that the crops are suitable as supplementary feed and has formulated ration recommendations that provide a factor of safety to remove any risks to animal health and subsequent human consumption.

It should be noted that the ration recommended by ANCS is not particularly unusual in the Australian context where supplementary feeding is commonly practiced.

4. Conclusions

Following completion of the first 9 months of an expected two year irrigation program on AGL's Tiedman property, the key soil and crop conclusions of the Stage 1A irrigation trial are:

- The incorporation of ameliorant has produced a substantial improvement in soil quality in the trial area;
- The soil improvements (such as the slotting and addition of compost, lime and gypsum) have facilitated deep drainage as well as promoted deep root development for maximum water take-up by plants;
- The soils are taking in water at a significantly higher rate than the parent soils;
- As a result of the improved soil quality, it has been possible to establish high water-using crops;
- As a result of healthy growth of crops, with high water demand, it has been possible to irrigate significant amounts of blended water (44.62 ML in the 7 months to 31 March 2014);
- With a blended water quality of 1500 Ec there is minimal observed effect on parent/ameliorated soils to date (although a slight increase in salinity at one site was evident in the November 2013 soil sampling event);
- Harvested crop nutritional qualities are very good;
- The macro ion concentrations in plants together with trace metal and other concentrations has shown some correlation with the K and Cl concentrations (macro minerals) and Al, Br, and Fe concentrations (trace minerals) in the blended produced water;
- Similar minerals also occur in the compost, soils and weathered rocks so it is not possible to differentiate whether the mineral uptake in crops are mostly derived from the soils or the water;
- There are no elevated concentrations of trace metals (or priority heavy metals) in the harvested fodder;
- Around 3.6 tonnes of salt were exported in the fodder crops harvested over this 7 month period;
- An independent animal nutritionist has concluded that the crops are suitable as supplementary feed and has formulated ration recommendations that provide a factor of safety to remove any risks to animal health and subsequent human consumption; and
- The Maximum Tolerance Levels (MTL) of a range of macro minerals, trace minerals and other minerals were not exceeded for cattle or sheep (for either lucerne or forage sorghum).

References

Fodder King (FK), 2013a. *Soil quality monitoring and management, Report 1 – Pre irrigation (Activities to 31 March 2013)*

Fodder King (FK), 2013b, *Soil quality monitoring and management, Report 2 – Irrigation (Activities from 1 April to 30 June 2013) Tiedman Irrigation Trial*

Fodder King (FK), 2013c, *Summary Report 1 (Soil and cropping activities to 31st August 2013)*

Fodder King (FK), 2014 *Soil quality monitoring and management, Report 3 - Irrigation (Activities from 1 July to 31 December 2013) Tiedman Irrigation Program*

Parsons Brinckerhoff (PB), 2014, *Tiedman Irrigation Program – Water Compliance Report for the Period 1 July to 31 December 2013 Gloucester Gas Project*

Terms and Abbreviations

Acid Detergent Fibre (ADF%) ADF is the result of deducting the hemi-cellulose component from NDF.

Crude Protein (CP % of Dry Matter) CP is the total nitrogen (N) in the diet, which includes not only true protein but also non-protein nitrogen which has the potential to be utilised for protein synthesis by organisms within an animal's stomach. N is measured and CP derived by multiplying N by a factor of 6.25. The higher the value, the greater the amount of protein available to the animal.

Dry Matter (DM%) DM is everything remaining after the water in a feed sample has been removed. DM includes the energy, protein, vitamins and minerals required by animals for maintenance and production.

Dry Matter Digestibility (DMD %) DMD is the percentage of the dry matter in a feed analysis that is able to be digested by animals. The higher the value the greater the uptake of feed by the animal.

Dry Organic Matter Digestibility (DOMD%) DOMD is the percentage of the organic matter component that can be digested by the animal.

Heavy Metals Commonly used term that refers to metals that are toxic. The priority heavy metals are generally copper, chromium, arsenic, lead, cadmium, nickel, mercury and zinc.

Maximum Tolerance Level the dietary level that when fed for a defined period will not impair animal health or performance and should not produce unsafe residues in human food derived from the animal.

Macro Minerals Essential minerals (required in gram amounts per day) required for maintenance, health, growth, reproduction, lactation and fattening of animals.

Metabolisable Energy (ME as mj/kg of Dry Matter) ME is the feed energy available for animal production after accounting for losses from faeces, urine and gaseous products of digestion. The higher the value, the greater the amount of energy available to the animal.

Neutral Detergent Fibre (NDF %) NDF is a measure of the three structural carbohydrates in the feed – cellulose, hemi-cellulose and lignin. It is sometimes referred to as the cell wall constituent of the feed and represents the least digestible component of the feed. The lower the value, the greater the amount of feed that can be easily consumed by the animal.

Trace Metals Essential minerals (minerals required in mg or less per day) required for maintenance, health, growth, reproduction, lactation and fattening of animals.

ADF Acid detergent fibre
CP Crude protein
DM Dry matter
DMD Dry matter digestibility
DOMD Dry organic matter digestibility
EC Electrical conductivity
ECEC Effective cation exchange capacity
ME Metabolisable energy
MTL Maximum tolerance levels
NDF Neutral detergent fibre
SHC Saturated hydraulic conductivity
WHC Water holding capacity

Attachment 1

FeedTest Laboratory Reports – Feed analysis results

(in chronological order)

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FEED ANALYSIS REPORT

AGL Upstream Investments Pty Ltd
22 Tate Street
Gloucester NSW 2422

ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1309-0742

DATE RECEIVED 23 September 2013
OUR SAMPLE NUMBER S2013-26212
YOUR REFERENCE AGL Stage 1A Triticale
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 18 September 2013

TEST	Result
Chloride	
Chloride (% of dry matter)	1.47
Dietary Cation-Anion Difference	
DCAD ((Na+K)-(Cl+S)) (meq/kg)	452
Metals - ICP	
Aluminium (mg/kg)	25
Boron (mg/kg)	2.6
Calcium (mg/kg)	2800
Copper (mg/kg)	3.4
Iron (mg/kg)	89
Potassium (mg/kg)	40000
Magnesium (mg/kg)	1600
Manganese (mg/kg)	54
Sodium (mg/kg)	540
Phosphorus (mg/kg)	4900
Sulphur (mg/kg)	2900
Zinc (mg/kg)	43
NIR Package	
Dry Matter (%)	18.4
Moisture (%)	81.6
Crude Protein (% of dry matter)	20.8
Acid Detergent Fibre (% of dry matter)	24.5
Neutral Detergent Fibre (% of dry matter)	48.1
Digestibility (DMD) (% of dry matter)	75.3
Digestibility (DOMD) (Calculated) (% of dry matter)	70.6
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.3

Report Number: 92430
Issued: 30 Sep 2013

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FEED ANALYSIS REPORT

AGL Upstream Investments Pty Ltd
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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1309-0742

Note: This report is not to be reproduced except in full.

Final Report

Report Number: 92430

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Karen Jackson

Team Leader, Food Safety Laboratory

30 September 2013

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1309-0742

DATE RECEIVED 23 September 2013
OUR SAMPLE NUMBER S2013-26213
YOUR REFERENCE AGL Stage 1A Lucerne
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 18 September 2013

TEST	Result
Chloride	
Chloride (% of dry matter)	1.29
Dietary Cation-Anion Difference	
DCAD ((Na+K)-(Cl+S)) (meq/kg)	576
Metals - ICP	
Aluminium (mg/kg)	27
Boron (mg/kg)	25
Calcium (mg/kg)	14000
Copper (mg/kg)	2.2
Iron (mg/kg)	83
Potassium (mg/kg)	44000
Magnesium (mg/kg)	3200
Manganese (mg/kg)	36
Sodium (mg/kg)	1300
Phosphorus (mg/kg)	3600
Sulphur (mg/kg)	3900
Zinc (mg/kg)	37
NIR Package	
Dry Matter (%)	20.2
Moisture (%)	79.8
Crude Protein (% of dry matter)	29.1
Acid Detergent Fibre (% of dry matter)	22.3
Neutral Detergent Fibre (% of dry matter)	29.0
Digestibility (DMD) (% of dry matter)	76.2
Digestibility (DOMD) (Calculated) (% of dry matter)	71.4
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.5

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PROJECT NUMBER J1309-0742

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Final Report

Report Number: 92430

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Karen Jackson

Team Leader, Food Safety Laboratory

30 September 2013

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1309-0742

DATE RECEIVED 23 September 2013
OUR SAMPLE NUMBER S2013-26214
YOUR REFERENCE Tiedmans/Silage/Lucerne/Cut 1
SAMPLE TYPE Silage
DESCRIPTION
DATE SAMPLE COLLECTED 20 September 2013

TEST	Result
NIR Package	
Dry Matter (%)	30.9
Moisture (%)	69.1
Crude Protein (% of dry matter)	19.3
Acid Detergent Fibre (% of dry matter)	18.7
Neutral Detergent Fibre (% of dry matter)	42.1
Digestibility (DMD) (% of dry matter)	73.4
Digestibility (DOMD) (Calculated) (% of dry matter)	69.0
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.0

Final Report

Report Number: 92430

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = 0.16 x DOMD%

AFIA Grade for legume and pasture hay + silage : A1

Please note: Dry Matter (DM%), Crude Protein (CP%) and Digestibility (DMD%) have been corrected in accordance with AFIA approved methods.

Karen Jackson

Team Leader, Food Safety Laboratory

30 September 2013

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1309-0742

DATE RECEIVED 23 September 2013
OUR SAMPLE NUMBER S2013-26215
YOUR REFERENCE Tiedmans/Silage/Triticale Cut
SAMPLE TYPE Silage Cereal
DESCRIPTION
DATE SAMPLE COLLECTED 20 September 2013

TEST	Result
NIR Package	
Dry Matter (%)	44.2
Moisture (%)	55.8
Crude Protein (% of dry matter)	11.6
Acid Detergent Fibre (% of dry matter)	35.4
Neutral Detergent Fibre (% of dry matter)	66.2
Digestibility (DMD) (% of dry matter)	55.9
Digestibility (DOMD) (Calculated) (% of dry matter)	54.1
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	8.7

Final Report

Report Number: 92430

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = 0.16 x DOMD%

AFIA Grade for cereal hay + silage : B1

Please note: Dry Matter (DM%), Crude Protein (CP%) and Digestibility (DMD%) have been corrected in accordance with AFIA approved methods.

Karen Jackson

Team Leader, Food Safety Laboratory

30 September 2013

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1311-1778

DATE RECEIVED 29 November 2013
OUR SAMPLE NUMBER S2013-34392
YOUR REFERENCE 1 A LUCERNE CUT 3
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 01 November 2013

TEST	Result
NIR Package	
Dry Matter (%)	47.3
Moisture (%)	52.7
Crude Protein (% of dry matter)	29.4
Acid Detergent Fibre (% of dry matter)	20.6
Neutral Detergent Fibre (% of dry matter)	28.2
Digestibility (DMD) (% of dry matter)	78.5
Digestibility (DOMD) (Calculated) (% of dry matter)	73.3
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	11.9

Final Report

Report Number: 96217

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Rick Stadler

Customer Services Manager

03 December 2013

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1312-1135

DATE RECEIVED 19 December 2013
OUR SAMPLE NUMBER S2013-37109
YOUR REFERENCE NO 11 TRIT SILAGE CUT 2
SAMPLE TYPE Silage
DESCRIPTION
DATE SAMPLE COLLECTED 16 December 2013

TEST	Result
NIR Package	
Dry Matter (%)	56.1
Moisture (%)	43.9
Crude Protein (% of dry matter)	17.6
Acid Detergent Fibre (% of dry matter)	31.3
Neutral Detergent Fibre (% of dry matter)	57.8
Digestibility (DMD) (% of dry matter)	67.9
Digestibility (DOMD) (Calculated) (% of dry matter)	64.4
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.3

Note: **This report is not to be reproduced except in full.**

Final Report

Report Number: 97975

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = 0.16 x DOMD%

AFIA Grade for legume and pasture hay + silage : A2

Please note: Dry Matter (DM%), Crude Protein (CP%) and Digestibility (DMD%) have been corrected in accordance with AFIA approved methods.

Joanne Warnes

Analyst, Quality & Milling Laboratory

31 December 2013

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Gloucester NSW 2422

ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1312-1135

DATE RECEIVED 19 December 2013
OUR SAMPLE NUMBER S2013-37107
YOUR REFERENCE NO 12 LUCERNE SILAGE CUT 2
SAMPLE TYPE Silage
DESCRIPTION
DATE SAMPLE COLLECTED 16 December 2013

TEST	Result
NIR Package	
Dry Matter (%)	69.3
Moisture (%)	30.7
Crude Protein (% of dry matter)	27.3
Acid Detergent Fibre (% of dry matter)	26.8
Neutral Detergent Fibre (% of dry matter)	38.1
Digestibility (DMD) (% of dry matter)	71.2
Digestibility (DOMD) (Calculated) (% of dry matter)	67.1
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.7

Note: **This report is not to be reproduced except in full.**

Final Report

Report Number: 97975

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = 0.16 x DOMD%

AFIA Grade for legume and pasture hay + silage : A1

Please note: Dry Matter (DM%), Crude Protein (CP%) and Digestibility (DMD%) have been corrected in accordance with AFIA approved methods.

Joanne Warnes

Analyst, Quality & Milling Laboratory

31 December 2013

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1312-1315

DATE RECEIVED 23 December 2013
OUR SAMPLE NUMBER S2013-37554
YOUR REFERENCE NO 13 LUCERNE HAY CUT 3
SAMPLE TYPE Hay
DESCRIPTION
DATE SAMPLE COLLECTED 16 December 2013

TEST	Result
NIR Package	
Dry Matter (%)	78.9
Moisture (%)	21.1
Crude Protein (% of dry matter)	26.3
Acid Detergent Fibre (% of dry matter)	23.2
Neutral Detergent Fibre (% of dry matter)	37.2
Digestibility (DMD) (% of dry matter)	71.0
Digestibility (DOMD) (Calculated) (% of dry matter)	67.0
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.6

Note: **This report is not to be reproduced except in full.**

Final Report

Report Number: 97942

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

AFIA Grade for legume and pasture hay + silage : A1

Joanne Warnes

Analyst, Quality & Milling Laboratory

31 December 2013

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1312-1206

DATE RECEIVED 20 December 2013
OUR SAMPLE NUMBER S2013-37369
YOUR REFERENCE NO 14 SORGHUM CUT 1 FRESH
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 16 December 2013

TEST	Result
Chloride	
Chloride (% of dry matter)	1.56
Dietary Cation-Anion Difference	
DCAD ((Na+K)-(Cl+S)) (meq/kg)	354
Metals - ICP	
Aluminium (mg/kg of dry matter)	150
Boron (mg/kg of dry matter)	5.1
Calcium (mg/kg of dry matter)	3100
Copper (mg/kg of dry matter)	4.0
Iron (mg/kg of dry matter)	89
Potassium (mg/kg of dry matter)	34000
Magnesium (mg/kg of dry matter)	2900
Manganese (mg/kg of dry matter)	75
Sodium (mg/kg of dry matter)	110
Phosphorus (mg/kg of dry matter)	2700
Sulphur (mg/kg of dry matter)	1300
Zinc (mg/kg of dry matter)	33
NIR Package	
Dry Matter (%)	11.8
Moisture (%)	88.2
Crude Protein (% of dry matter)	10.7
Acid Detergent Fibre (% of dry matter)	31.1
Neutral Detergent Fibre (% of dry matter)	58.9
Digestibility (DMD) (% of dry matter)	69.2
Digestibility (DOMD) (Calculated) (% of dry matter)	65.4
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.3

Report Number: 98076
Issued: 02 Jan 2014

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Gloucester NSW 2422

ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1312-1206

Note: This report is not to be reproduced except in full.

Final Report

Report Number: 98076

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Analyst, Quality & Milling Laboratory

02 January 2014

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22 Tate Street
Gloucester NSW 2422

ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1312-1135

DATE RECEIVED 19 December 2013
OUR SAMPLE NUMBER S2013-37108
YOUR REFERENCE NO 15 LUC CUT 4 FRESH
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 16 December 2013

TEST	Result
Chloride	
Chloride (% of dry matter)	1.38
Dietary Cation-Anion Difference	
DCAD ((Na+K)-(Cl+S)) (meq/kg)	220
Metals - ICP	
Aluminium (mg/kg of dry matter)	25
Boron (mg/kg of dry matter)	38
Calcium (mg/kg of dry matter)	13000
Copper (mg/kg of dry matter)	3.5
Iron (mg/kg of dry matter)	73
Potassium (mg/kg of dry matter)	31000
Magnesium (mg/kg of dry matter)	2400
Manganese (mg/kg of dry matter)	45
Sodium (mg/kg of dry matter)	1500
Phosphorus (mg/kg of dry matter)	2600
Sulphur (mg/kg of dry matter)	4000
Zinc (mg/kg of dry matter)	25
NIR Package	
Dry Matter (%)	29.5
Moisture (%)	70.5
Crude Protein (% of dry matter)	22.2
Acid Detergent Fibre (% of dry matter)	27.2
Neutral Detergent Fibre (% of dry matter)	34.3
Digestibility (DMD) (% of dry matter)	68.2
Digestibility (DOMD) (Calculated) (% of dry matter)	64.6
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.1

Report Number: **97975**
Issued: 31 Dec 2013

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FEED ANALYSIS REPORT

AGL Upstream Investments Pty Ltd
22 Tate Street
Gloucester NSW 2422

ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1312-1135

Note: This report is not to be reproduced except in full.

Final Report

Report Number: 97975

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Analyst, Quality & Milling Laboratory

31 December 2013

Australian Wool Testing Authoriy Ltd - Trading as Agrifood Technology Pty Ltd ABN 43 006 014 106
FEEDTEST, PO Box 728, Werribee Victoria 3030
Telephone 1300 655 474 Facsimile 03 9742 3344 Email feed.test@agrifood.com.au

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FEED ANALYSIS REPORT

AGL Upstream Investments Pty Ltd
22 Tate Street
Gloucester NSW 2422

ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1312-1456

DATE RECEIVED 31 December 2013
OUR SAMPLE NUMBER S2013-37936
YOUR REFERENCE NO 17 Lucerne Hay Cat 4
SAMPLE TYPE Hay
DESCRIPTION
DATE SAMPLE COLLECTED 24 December 2013

TEST	Result
NIR Package	
Dry Matter (%)	81.5
Moisture (%)	18.5
Crude Protein (% of dry matter)	20.8
Acid Detergent Fibre (% of dry matter)	25.9
Neutral Detergent Fibre (% of dry matter)	37.4
Digestibility (DMD) (% of dry matter)	67.9
Digestibility (DOMD) (Calculated) (% of dry matter)	64.3
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.1

Note: **This report is not to be reproduced except in full.**

Final Report

Report Number: 98179

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

AFIA Grade for legume and pasture hay + silage : A1

Joanne Warnes

Analyst, Quality & Milling Laboratory

06 January 2014

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AGL Upstream Investments Pty Ltd
22 Tate Street
Gloucester NSW 2422

ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1401-0836

DATE RECEIVED 16 January 2014
OUR SAMPLE NUMBER S2014-01911
YOUR REFERENCE 18 SORGHAM CUT 2 FRESH
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 13 January 2014

TEST	Result
Chloride	
Chloride (% of dry matter)	2.12
Dietary Cation-Anion Difference	
DCAD ((Na+K)-(Cl+S)) (meq/kg)	191
Metals - ICP	
Aluminium (mg/kg)	100
Boron (mg/kg)	4.5
Calcium (mg/kg)	2900
Copper (mg/kg)	3.3
Iron (mg/kg)	91
Potassium (mg/kg)	34000
Magnesium (mg/kg)	3800
Manganese (mg/kg)	61
Sodium (mg/kg)	420
Phosphorus (mg/kg)	3300
Sulphur (mg/kg)	1600
Zinc (mg/kg)	32
NIR Package	
Dry Matter (%)	35.8
Moisture (%)	64.2
Crude Protein (% of dry matter)	15.0
Acid Detergent Fibre (% of dry matter)	28.1
Neutral Detergent Fibre (% of dry matter)	57.9
Digestibility (DMD) (% of dry matter)	72.2
Digestibility (DOMD) (Calculated) (% of dry matter)	68.0
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	10.8
Water Soluble Carbohydrates (% of dry matter)	0.0

Report Number: 99287
Issued: 29 Apr 2014

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ATTENTION Andrew Lenehan
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PURCHASE ORDER None
PROJECT NUMBER J1401-0836

Note: This report is not to be reproduced except in full.

Final Report

Report Number: 99287

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Rick Stadler

Customer Services Manager

29 April 2014

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1401-0836

DATE RECEIVED 16 January 2014
OUR SAMPLE NUMBER S2014-01912
YOUR REFERENCE 19 LUCERNE CUT 5 FRESH
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 13 January 2014

TEST	Result
Chloride	
Chloride (% of dry matter)	1.87
Dietary Cation-Anion Difference	
DCAD ((Na+K)-(Cl+S)) (meq/kg)	229
Metals - ICP	
Aluminium (mg/kg)	27
Boron (mg/kg)	23
Calcium (mg/kg)	8200
Copper (mg/kg)	3.7
Iron (mg/kg)	82
Potassium (mg/kg)	36000
Magnesium (mg/kg)	3200
Manganese (mg/kg)	70
Sodium (mg/kg)	2800
Phosphorus (mg/kg)	3200
Sulphur (mg/kg)	4600
Zinc (mg/kg)	34
NIR Package	
Dry Matter (%)	19.2
Moisture (%)	80.8
Crude Protein (% of dry matter)	24.3
Acid Detergent Fibre (% of dry matter)	27.9
Neutral Detergent Fibre (% of dry matter)	38.8
Digestibility (DMD) (% of dry matter)	66.4
Digestibility (DOMD) (Calculated) (% of dry matter)	63.1
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.8

Report Number: 99287
Issued: 29 Apr 2014

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ATTENTION Andrew Lenehan
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PURCHASE ORDER None
PROJECT NUMBER J1401-0836

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Final Report

Report Number: 99287

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Rick Stadler

Customer Services Manager

29 April 2014

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1401-1681

DATE RECEIVED 31 January 2014
OUR SAMPLE NUMBER S2014-03853
YOUR REFERENCE NO 20 Sorgham Silage Cut 1
SAMPLE TYPE Silage
DESCRIPTION
DATE SAMPLE COLLECTED 29 January 2014

TEST	Result
NIR Package	
Dry Matter (%)	33.5
Moisture (%)	66.5
Crude Protein (% of dry matter)	9.3
Acid Detergent Fibre (% of dry matter)	35.4
Neutral Detergent Fibre (% of dry matter)	67.8
Digestibility (DMD) (% of dry matter)	64.1
Digestibility (DOMD) (Calculated) (% of dry matter)	61.1
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.8

Note: **This report is not to be reproduced except in full.**

Final Report

Report Number: 100098

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = 0.16 x DOMD%

AFIA Grade for legume and pasture hay + silage : A3

Please note: Dry Matter (DM%), Crude Protein (CP%) and Digestibility (DMD%) have been corrected in accordance with AFIA approved methods.

Joanne Warnes

Analyst, Quality & Milling Laboratory

05 February 2014

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Gloucester NSW 2422

ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1401-1681

DATE RECEIVED 31 January 2014
OUR SAMPLE NUMBER S2014-03855
YOUR REFERENCE no 21 Sorgham hay cut 2
SAMPLE TYPE Hay
DESCRIPTION
DATE SAMPLE COLLECTED 29 January 2014

TEST	Result
NIR Package	
Dry Matter (%)	62.4
Moisture (%)	37.6
Crude Protein (% of dry matter)	11.8
Acid Detergent Fibre (% of dry matter)	31.5
Neutral Detergent Fibre (% of dry matter)	63.0
Digestibility (DMD) (% of dry matter)	66.9
Digestibility (DOMD) (Calculated) (% of dry matter)	63.5
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.9

Note: **This report is not to be reproduced except in full.**

Final Report

Report Number: 100098

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

AFIA Grade for legume and pasture hay + silage : A3

Joanne Warnes

Analyst, Quality & Milling Laboratory

05 February 2014

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1401-1681

DATE RECEIVED 31 January 2014
OUR SAMPLE NUMBER S2014-03854
YOUR REFERENCE NO 22 Lucerne Hay Cut 5
SAMPLE TYPE Hay
DESCRIPTION
DATE SAMPLE COLLECTED 29 January 2014

TEST	Result
NIR Package	
Dry Matter (%)	79.2
Moisture (%)	20.8
Crude Protein (% of dry matter)	25.0
Acid Detergent Fibre (% of dry matter)	27.9
Neutral Detergent Fibre (% of dry matter)	39.4
Digestibility (DMD) (% of dry matter)	66.0
Digestibility (DOMD) (Calculated) (% of dry matter)	62.7
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.7

Note: **This report is not to be reproduced except in full.**

Final Report

Report Number: 100098

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

AFIA Grade for legume and pasture hay + silage : A1

Joanne Warnes

Analyst, Quality & Milling Laboratory

05 February 2014

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AGL Upstream Investments Pty Ltd
22 Tate Street
Gloucester NSW 2422

ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1403-0574

DATE RECEIVED 14 March 2014
OUR SAMPLE NUMBER S2014-08883
YOUR REFERENCE No 23 Sorghum Cut 3 Fresh
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 24 February 2014

TEST	Result
Chloride	
Chloride (% of dry matter)	1.17
Fluoride	
Fluoride (mg/kg)	0.5
Inorganic Bromide	
Inorganic Bromide (mg/kg)	130
Iodine	
Iodine (mg/kg)	0.72
Mercury	
Mercury (mg/kg)	<0.010
Metals - ICP	
Aluminium (mg/kg)	200
Arsenic (mg/kg)	<0.10
Barium (mg/kg)	7.9
Boron (mg/kg)	3.5
Calcium (mg/kg)	2500
Cadmium (mg/kg)	0.17
Cobalt (mg/kg)	0.12
Copper (mg/kg)	11
Iron (mg/kg)	120
Potassium (mg/kg)	25000
Magnesium (mg/kg)	3900
Manganese (mg/kg)	62
Molybdenum (mg/kg)	1.3
Sodium (mg/kg)	190
Nickel (mg/kg)	5.7
Phosphorus (mg/kg)	4400
Lead (mg/kg)	0.47
Sulphur (mg/kg)	1400
Selenium (mg/kg)	0.27

Report Number: 103911
Issued: 28 Mar 2014

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1403-0574

Silicon (mg/kg)	26
Strontium (mg/kg)	18
Zinc (mg/kg)	34
Lithium (mg/kg)	0.2140
NIR Package	
Dry Matter (%)	21.3
Moisture (%)	78.7
Crude Protein (% of dry matter)	8.4
Acid Detergent Fibre (% of dry matter)	33.6
Neutral Detergent Fibre (% of dry matter)	64.5
Digestibility (DMD) (% of dry matter)	64.5
Digestibility (DOMD) (Calculated) (% of dry matter)	61.5
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.5

Final Report

Report Number: 103911

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Analyst, Quality & Milling Laboratory

28 March 2014

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1403-0574

DATE RECEIVED 14 March 2014
OUR SAMPLE NUMBER S2014-08884
YOUR REFERENCE No24 Lucerne Cut 6 Fresh
SAMPLE TYPE Pasture Fresh
DESCRIPTION
DATE SAMPLE COLLECTED 24 February 2014

TEST	Result
Chloride	
Chloride (% of dry matter)	0.50
Fluoride	
Fluoride (mg/kg)	0.4
Inorganic Bromide	
Inorganic Bromide (mg/kg)	160
Iodine	
Iodine (mg/kg)	0.60
Mercury	
Mercury (mg/kg)	<0.010
Metals - ICP	
Aluminium (mg/kg)	120
Arsenic (mg/kg)	<0.10
Barium (mg/kg)	14
Boron (mg/kg of dry matter)	62
Calcium (mg/kg of dry matter)	9800
Cadmium (mg/kg)	0.068
Cobalt (mg/kg of dry matter)	0.44
Copper (mg/kg of dry matter)	5.8
Iron (mg/kg of dry matter)	130
Potassium (mg/kg of dry matter)	28000
Magnesium (mg/kg of dry matter)	2000
Manganese (mg/kg of dry matter)	38
Molybdenum (mg/kg of dry matter)	2.8
Sodium (mg/kg of dry matter)	3200
Nickel (mg/kg)	1.7
Phosphorus (mg/kg of dry matter)	3200
Lead (mg/kg)	0.12
Sulphur (mg/kg of dry matter)	3300
Selenium (mg/kg of dry matter)	0.21

Report Number: 103911
Issued: 28 Mar 2014

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ATTENTION Andrew Lenehan
FAX NUMBER

PURCHASE ORDER None
PROJECT NUMBER J1403-0574

Silicon (mg/kg)	180
Strontium (mg/kg)	46
Zinc (mg/kg of dry matter)	29
Lithium (mg/kg)	2.5160
NIR Package	
Dry Matter (%)	31.4
Moisture (%)	68.6
Crude Protein (% of dry matter)	25.1
Acid Detergent Fibre (% of dry matter)	28.9
Neutral Detergent Fibre (% of dry matter)	37.9
Digestibility (DMD) (% of dry matter)	66.2
Digestibility (DOMD) (Calculated) (% of dry matter)	62.9
Est. Metabolisable Energy (Calculated) (MJ/kg DM)	9.8

Note: **This report is not to be reproduced except in full.**

Final Report

Report Number: 103911

Comments:

Metabolisable Energy has been calculated using the following equation:
ME = (0.203 x DOMD%) - 3.001

Joanne Warnes

Analyst, Quality & Milling Laboratory

28 March 2014

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Attachment 2

1. ANCS – AGL Forages - Feed analysis evaluation Report No.1

2. MNC Agronomy - Response to AGL Forages
Feed Analysis Evaluation Report No.1- ANCS

AGL FORAGES - FEED ANALYSIS EVALUATION REPORT No. 1

TO: FODDER KING LIMITED DATE: APRIL 2014

AIM:

The aim of this report is to evaluate the mineral safety of particular forages produced under irrigation of mixed surface and/or underground water derived from CSG extraction and destined for feeding to ruminant animals (cattle and sheep). In this report, harvested fresh Lucerne No 24 Cut 6 and fresh Sorghum No 23 Cut 3 pastures were the forages evaluated.

BACKGROUND:

There are over 60 inorganic elements or minerals found in soils, which are taken up by plants. Of those, 17 minerals have been found to be essential for animals. Essential minerals are required for maintenance, health, growth, reproduction, lactation and fattening of animals. Those required in gram amounts per day are referred to as Macro Minerals and these include calcium, phosphorus, sodium, chlorine, potassium, magnesium and sulphur. Those minerals required in mg or less per day are called Trace Minerals and include cobalt, copper, chromium, fluorine, iodine, iron, manganese, molybdenum, selenium and zinc.

Non-essential minerals are widely found in the earth and absorbed by plants in levels usually in mg per kg or less. A few maybe beneficial in certain circumstances, some are known for specific toxic effects and others are regarded as highly toxic affecting many animal organs and include cadmium, lead and mercury.

'Typical' values of minerals found in particular feeds are scarce in published nutritional tables. Where minerals levels are reported, a note is usually found stating that actual laboratory results for the particular feed type should be used when balancing minerals in a diet. The main reason is that there is a fairly direct relationship between soil mineral content and the mineral content of the plant grown on a specific soil. The soil mineral content is derived from the rock underneath and from any minerals blown or found in irrigated water applied to the land. The differences found in mineral content between plant types is in part related to their intrinsic capacities to absorb individual minerals and to other factors such as soil temperature and weather conditions.

A more useful way to compare mineral content of a particular feed is against Maximum Tolerance Level (MTL) recommendations, periodically defined by government research authorities in USA and Europe for most minerals found in feeds. There are no Australian based MTLs.
MTL is defined as "… that dietary level that when fed for a defined period will not impair animal health or performance and should not produce unsafe residues in human food derived from animal" (The Minerals Directory 2007). This period is 10 days or more of consuming the mineral at MTL (NRC 2005). MTL are also based on highly soluble forms of the minerals and on the assumption that minerals in drinking water are minimal and there are no other minerals in the diet that might be antagonised.

TESTING PROCEDURE:

After harvest of a reasonable quantity of the above mentioned forages from a specified number of hectares in a farm/section, 10-20 samples of green forage were collected to obtain a well-mixed representative sample. Grab samples of the harvested fresh Lucerne pasture No 24 Cut 6 and fresh Sorghum pasture No 23 Cut 3 were collected on the 24th February 2014, mixed into representative samples and sent to FeedTest Laboratories, Werribee, Vic. a NATA accredited laboratory for Near Infrared Reflectance (NIR) and wet chemistry mineral testing.

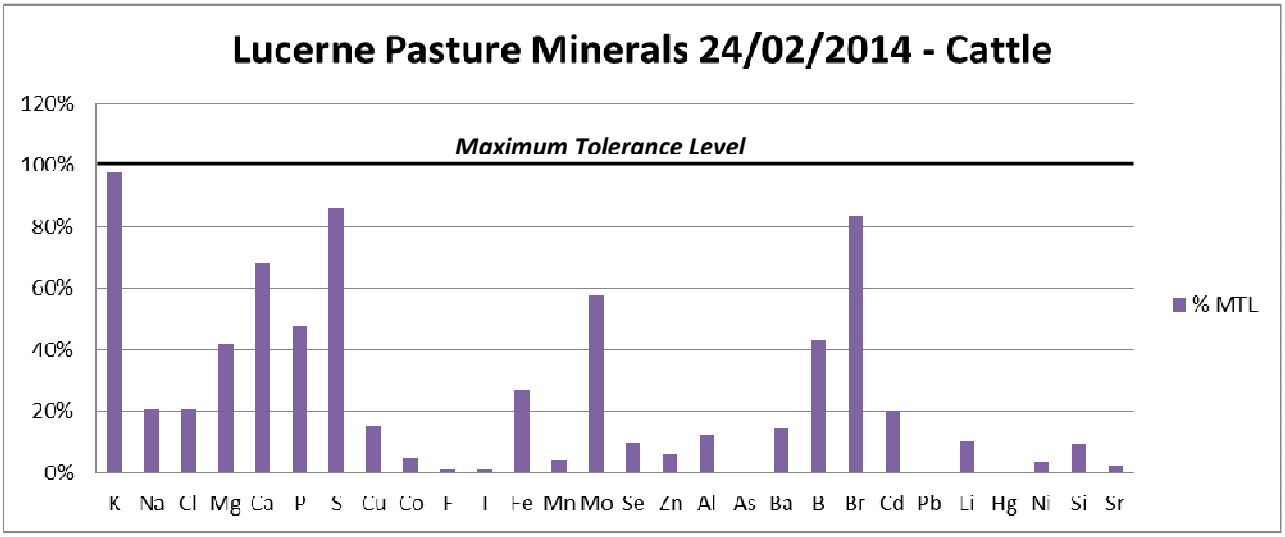
After a two-stage drying process, the representative samples were analysed by FeedTest for the macro minerals K, Na, Cl, Mg, Ca, P, S, trace minerals Cu, Co, I, F, Fe, Mn, Mo, Se, Zn, and other minor but potentially toxic minerals Al, As, B, Ba, Br, Cd, Hg, Li, Ni, Pb, Si and Sr. All minerals with exception of Mercury (Hg) and Chloride (Cl) were measured by a technique called Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES) according to AS 3641.2 1999, which is widely regarded as adequate due to its high level of sensitivity. Chloride (Cl) was measured by titration with Silver Nitrate according to AOAC Official Methods (Suppl. Mar.1997). Mercury (Hg) was measured by a FeedTest in-house method based on Schachter, M.M. and Boyer, K.W., Digestion of Organic Matrices with a single acid for Trace Element Determination, Anal. Chem. 52, pp 360-364, recommended practice for Vapor Generation Atomic Absorption Spectroscopy AS 2134.3 RN 1221.

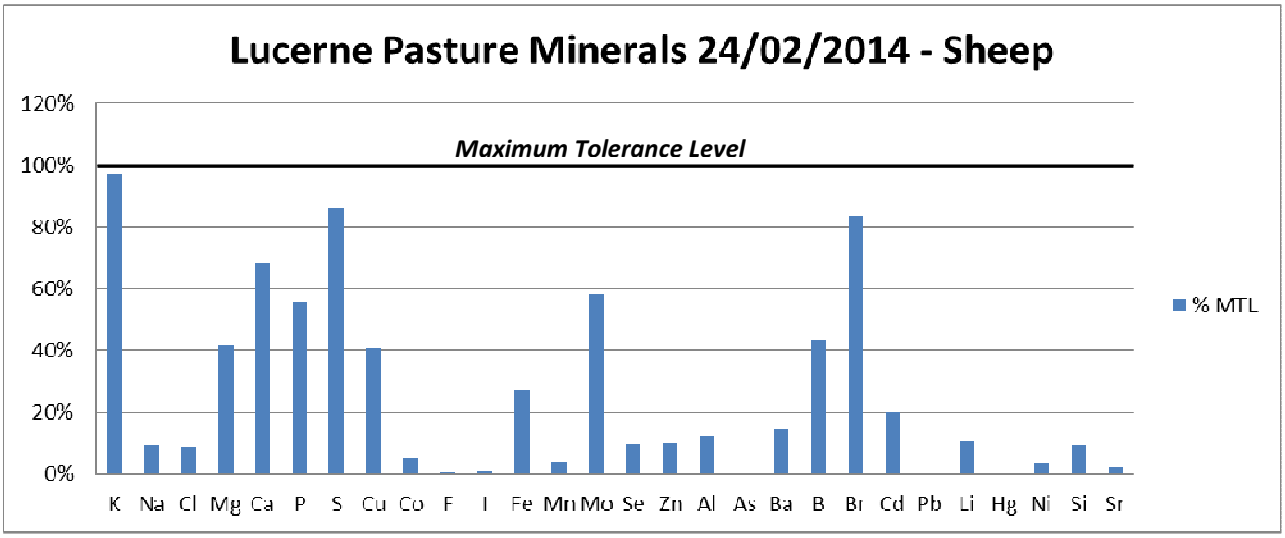
RESULTS & COMPARISON WITH INTERNATIONAL MAXIMUM TOLERANCE LEVELS (MTL'S):

The mineral laboratory results for the fresh Lucerne pasture No 24 Cut 6 and fresh Sorghum pasture No 23 Cut 3 are reported below. These laboratory results were compared against Maximum Tolerance Level (MTL) recommendations as described in the background section. It assumes that each pasture will be the sole feed source for cattle and sheep for 10 days or more.

FORAGE SAMPLE:			LUCERNE PASTURE		
			FRESH		
			No 24 Cut 6		
Date:			24/02/2014		
			Laboratory results	CATTLE	SHEEP
Macro Minerals		unit/DM	Level detected DMB	% OF MTL	% OF MTL
Potassium	K	mg/kg	29227.6	97%	97%
Sodium	Na	mg/kg	3340.3	21%	10%
Chloride	Cl	mg/kg	5000	21%	9%
Magnesium	Mg	mg/kg	2087.7	42%	42%
Calcium	Ca	mg/kg	10229.6	68%	68%
Phosphorus	P	mg/kg	3340.3	48%	56%
Sulphur	S	mg/kg	3444.7	86%	86%
Trace Minerals					
Copper	Cu	mg/kg	6.1	15%	41%
Cobalt	Co	mg/kg	0.5	5%	5%
Fluoride	F	mg/kg	0.4	1%	1%
Iodine	I	mg/kg	0.6	1%	1%
Iron	Fe	mg/kg	135.7	27%	27%
Manganese	Mn	mg/kg	39.7	4%	4%
Molybdenum	Mo	mg/kg	2.9	58%	58%
Selenium	Se	mg/kg	0.2	10%	10%
Zinc	Zn	mg/kg	30.3	6%	10%
Other minor Minerals					
Aluminum	Al	mg/kg	125.3	13%	13%
Arsenic	As	mg/kg	0.1	0%	0%
Barium	Ba	mg/kg	14.6	15%	15%
Boron	B	mg/kg	64.7	43%	43%
Bromide inorganic	Br	mg/kg	167.0	84%	84%
Cadmium	Cd	mg/kg	0.1	20%	20%
Lead	Pb	mg/kg	0.1	0%	0%
Lithium	Li	mg/kg	2.6	10%	10%
Mercury	Hg	mg/kg	0.01	1%	1%
Nickel	Ni	mg/kg	1.8	4%	4%
Silicon	Si	mg/kg	187.9	9%	9%
Strontium	Sr	mg/kg	48.0	2%	2%

Key: DMB = dry matter basis MTL = maximum tolerance level





FINDINGS:

None of the tested minerals in the Lucerne sample were above the MTL for cattle and sheep. However, levels detected of the minerals K, S and Mo have the potential for toxicity or antagonistic interactions with other minerals.

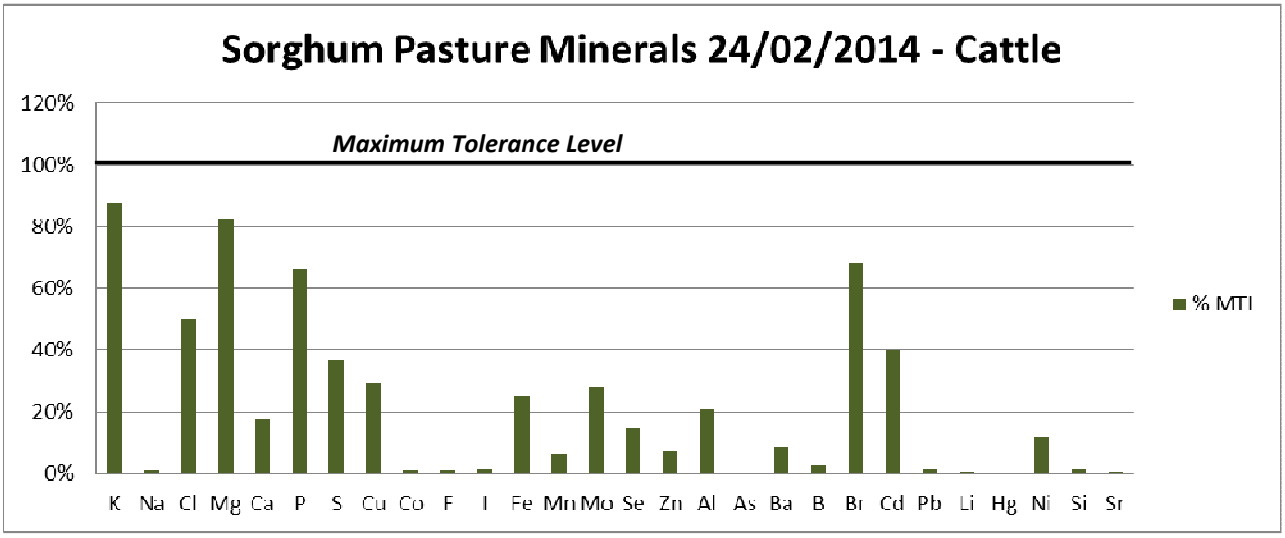
High K levels greatly reduce Mg absorption in the digestive tract. Low blood Mg can cause depressed appetite, staggers, nervousness, muscle twitching as well as other more serious conditions such as Grass Tetany where the animal can die.

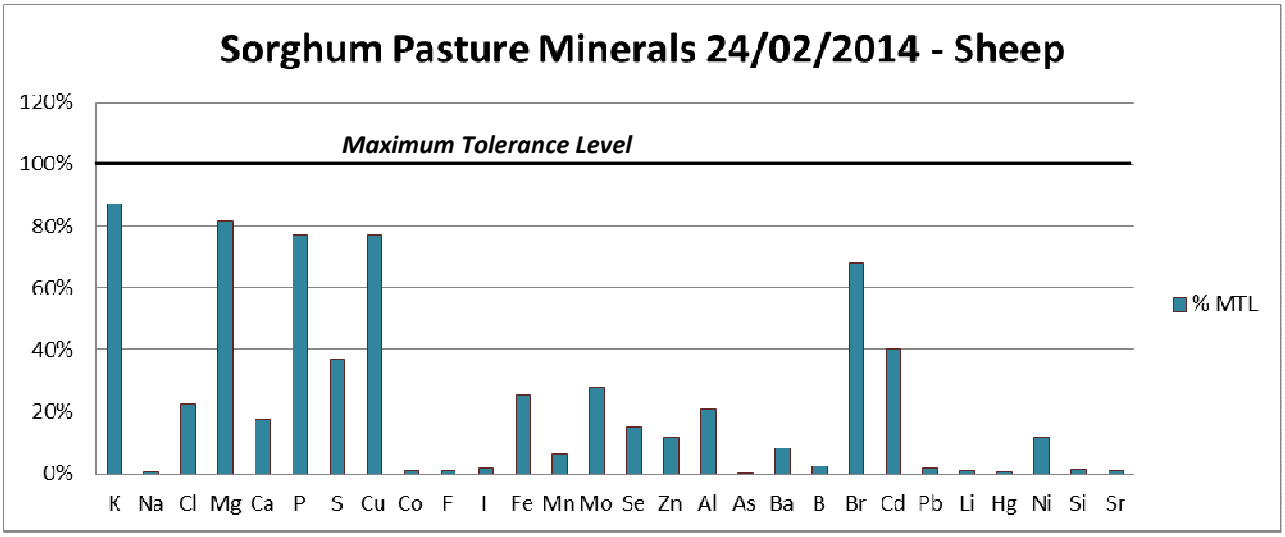
High S may bind Cu in the presence of Mo forming a Cu-Mo-S insoluble complex that affects Cu absorption and body storage. Low Cu levels in the body can lead to conditions such as hair depigmentation, poor fertility, decreased milk production and impaired immune response to disease challenges.

High S can also interfere with Se uptake in the digestive tract. Diarrhoea, muscle stiffness, retained placenta and cystic ovaries are some of the symptoms observed when Se levels are low in the body.

FORAGE SAMPLE:			SORGHUM PASTURE		
			FRESH		
			No 23 Cut 3		
Date:			24/02/2014		
Results:			Laboratory results	CATTLE	SHEEP
Macro Minerals		unit/DM	Level detected DMB	% OF MTL	% OF MTL
Potassium	K	mg/kg	26260.5	88%	88%
Sodium	Na	mg/kg	199.6	1%	1%
Chloride	Cl	mg/kg	12000	50%	22%
Magnesium	Mg	mg/kg	4096.6	82%	82%
Calcium	Ca	mg/kg	2626.1	18%	18%
Phosphorus	P	mg/kg	4621.8	66%	77%
Sulphur	S	mg/kg	1470.6	37%	37%
Trace Minerals					
Copper	Cu	mg/kg	11.6	29%	77%
Cobalt	Co	mg/kg	0.1	1%	1%
Fluoride	F	mg/kg	0.5	1%	1%
Iodine	I	mg/kg	0.8	2%	2%
Iron	Fe	mg/kg	126.1	25%	25%
Manganese	Mn	mg/kg	65.1	7%	7%
Molybdenum	Mo	mg/kg	1.4	28%	28%
Selenium	Se	mg/kg	0.3	15%	15%
Zinc	Zn	mg/kg	35.7	7%	12%
Other minor Minerals					
Aluminum	Al	mg/kg	210.1	21%	21%
Arsenic	As	mg/kg	0.1	0%	0%
Barium	Ba	mg/kg	8.3	8%	8%
Boron	B	mg/kg	3.7	2%	2%
Bromide	Br	mg/kg	136.6	68%	68%
Cadmium	Cd	mg/kg	0.2	40%	40%
Lead	Pb	mg/kg	0.5	2%	2%
Lithium	Li	mg/kg	0.2	1%	1%
Mercury	Hg	mg/kg	0.01	1%	1%
Nickel	Ni	mg/kg	6.0	12%	12%
Silicon	Si	mg/kg	27.3	1%	1%
Strontium	Sr	mg/kg	18.9	1%	1%

Key: DMB = dry matter basis MTL = maximum tolerance level





FINDINGS:

All the tested minerals in the Sorghum sample were below the MTL for cattle and sheep. However, levels detected of the minerals K have the potential for antagonistic interactions with other minerals.

High K levels greatly reduce Mg absorption in the digestive tract. Low blood Mg can cause depressed appetite, staggers, nervousness, muscle twitching as well as other more serious conditions such as Grass Tetany where the animal can die.

Sheep are very sensitive to Cu toxicity and this forage has levels close to MTL. High Cu levels accumulated in the liver can cause vomiting, salivation, abdominal pain, convulsions and death.

The levels of Br and Cd are also elevated and should be monitored. High Br may reduce growth. Cd is excreted very slowly and accumulates in the animal's body with potential toxicity in the animal and human that may consume its meat or milk. Effects of elevated Cd include anaemia, abortions, poor growth and milk production, reduced immune response and severe kidney damage.

RECOMMENDATIONS:

Harvested forages conserved in the form of hay or silage are generally fed to cattle and sheep as a complement to pastures or in conjunction to other feeds like grains and protein meals in intensive feeding systems. These include cattle and lamb feedlots. Hence, hays or silages are generally not 100% of the diet and it is the job of an animal nutritionist to design rations for a particular end-market requirement. The nutritionist will have to consider the nutritional values of the feed sources available including that of the pasture, hay or silage and other feeds to determine the proportions to be fed.

As a guideline to the nutritionist or feeder, below are recommendations on the maximum inclusion level (%) of the particular forages analysed in total daily rations dry matter basis (DMB) fed to cattle and sheep. These levels contain a safety margin to ensure that the dietary levels of the mineral elements are below the MTL to minimise the risk to animals and to human food derived from the animal.

	FORAGE:	**LUCERNE PASTURE**	**SORGHUM PASTURE**
		FRESH	FRESH
		No 24 Cut 6	No 23 Cut 3
	Date:	24/02/2014	24/02/2014
Specie	**Type**	**Max. incl. Level ration DMB**	**Max. incl. Level ration DMB**
Beef	Growing cattle	80%	90%
	Lactating cows	70%	80%
	Dry mature cows	80%	90%
Dairy	Growing heifers	80%	90%
	Springing cows	20%	30%
	Lactating cows	50%	50%
Sheep	Growing lambs	80%	50%
	Lactating ewes	60%	40%
	Dry pregnant ewes	50%	50%

Key: DMB = dry matter basis

VINCENT POSADA, B Sc, M Ag
CONSULTING NUTRITIONIST

MNC Agronomy

Consulting to Agriculture

29/4/2014

AGL Upstream Investments Pty Limited
Gloucester Irrigation Trial
Teidmans Lane
Gloucester NSW 2422

ATTN: Andrew Lenehan, Overseer

Dear Andrew,

RE: Response to AGL Forages – Feed Analysis Evaluation Report No.1- ANCS

In relation to the above report, the associated feed analyses, and recent soil test results, I will briefly comment on the elevated Potassium (K) levels in particular.

Firstly, I completely agree with the ANCS report into the potential plant and animal interactions due to the imbalances caused by elevated plant tissue K levels. Such imbalances are evident in particular in effluent re-use areas on many farms in the region, and as ANCS has highlighted, as forage grown in such areas is generally only utilized as a small proportion of the total forage ingested in an intensive grazing system, potential side-effects of such elevated levels are generally negated.

Furthermore, based upon the soil K levels in the recent soil analyses (Feb 2014), it is important to note soil K levels have decreased significantly in the past 12 months, with typical K removal of 22kg/K/tonne/DM harvested. In fact, given the high K removal in the recent months, and the continual removal set to occur over the coming crops, from an agronomic perspective moving forward it is important that soil K levels remain slightly high to ensure maximum crop utilization of the slightly high Sodium (Na) levels in the irrigation water. From a forage yield, and water utilization, perspective, maintaining adequate soil K levels is essential to mitigate any potential losses in growth caused by antagonisms in soil/plant water metabolism.

Essentially, the high plant tissue K levels currently and previously observed are a function of a rapidly changing soil structure caused by a large amount of ameliorants being incorporated into a poorly structured soil in a small timeframe. The feedlot manure alone added in excess of 180kg/K/ha, and as this is a highly mobile cation, its availability was extremely high initially. As the soil structure changes settle over the coming months, the soil and plant tissue nutrient levels will balance themselves, and I expect plant tissue K levels will reduce significantly.

Regards

Matt Thompson

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Disclaimer

The recommendations made in this report are based only on information available at the time of writing, and the success of implementation is reliant on many management and environmental factors out of the control of MNC Agronomy Pty Ltd. MNC Agronomy Pty Ltd does not have any detail of the current management practices and prevailing pasture status, and as such will not be liable for any damages suffered as a result of implementation of any of these recommendations.

If more specific information and/or advice are sort after, MNC Agronomy Pty Ltd recommends engaging its services to carry-out a specific and detailed audit of its current soil, plant and livestock system, thereby allowing for more specific and detailed recommendations.

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