



## FACT SHEET

### THE USE OF ELECTROMAGNETIC TECHNOLOGY TO DETERMINE NUTRIENT DISTRIBUTION IN ROTATIONAL OUTDOOR PIGGERIES

Outdoor Piggery Fact Sheet Series  
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A large proportion of the nutrients in pig feed are ultimately excreted as manure. These nutrients require careful management to ensure nutrients are not lost to the environment. One issue with managing nutrients in free range paddocks is the variability in nutrient levels within the free range area.

An APL project in which Nutrient Management Plans were prepared for numerous piggeries throughout Australia identified that nutrient overloading and uneven distribution of manure nutrients are particular concerns for rotational outdoor piggeries.

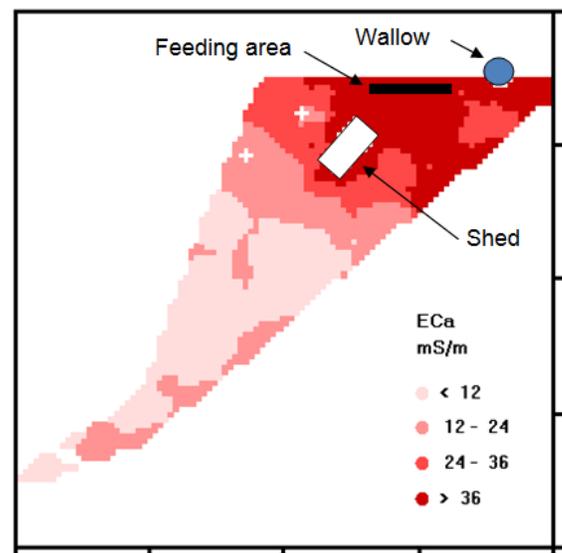
Another APL project used electromagnetic (EM) survey technology, coupled with soil testing, to provide better information on the distribution of nutrients in rotational outdoor piggeries. The use of EM technology has been researched and trialled as a successful method for assessing the spatial nutrient loading and potential environmental harm because manure and effluent application has a direct effect on the soil apparent conductivity ( $EC_a$ ).

Photo 1. Conducting EM Survey



Two outdoor piggeries were surveyed as part of the project. Figure 1 below shows the apparent soil conductivity ( $EC_a$ ) of a surveyed free range area, together with the location of infrastructure including the shelter, wallow and feeding area.

Figure 1. Apparent Soil Conductivity of Piggery Free Range Area





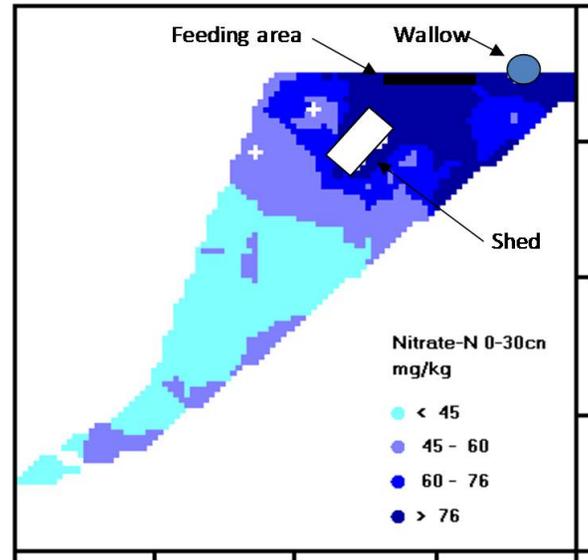
The EM soil surveys were carried out using an EM38-MK2, which is designed for relatively shallow applications, specifically within the plant root zone. The EM38-MK2 provides the measurement of ground conductivity using dual coil spacings of 0.5 m and 1.0 m concurrently. Data, including soil apparent conductivity and GPS location, was logged at intervals of approximately 1 per second, whilst towing the EM38-MK2 on a non ferrous sled behind a quad bike (see Photo 1).

The EM survey output was then imported to software from the data logger whilst in the field to enable timely and statistically relevant soil sampling designs. The program processed the dataset by excluding anomalies. Sampling designs that identified statistically relevant points were used to determine soil sampling locations in the areas surveyed. Representative soil samples were then collected and analysed for a range of soil nutrients and salts.

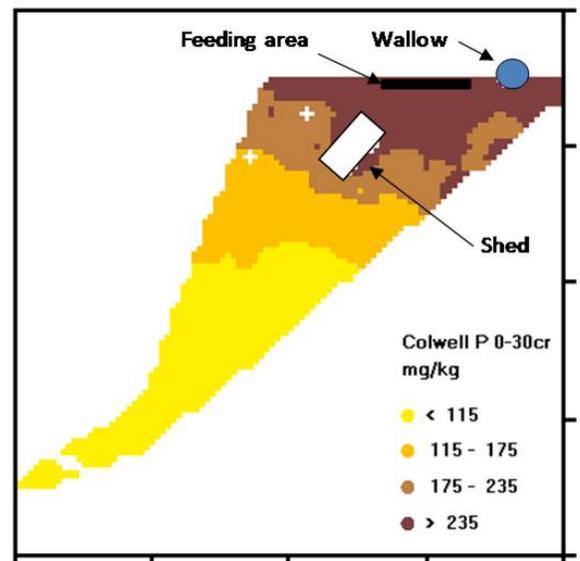
After the EM survey was completed and analysis results available, the ESAP-Calibrate program (Lesch et al. 2000) was used to determine the statistical relationship between  $EC_a$  and the various soil parameters of interest. From the statistical results, soil properties with high correlation ( $R^2$  value) were mapped to show the predicted distribution of that parameter.

Statistical analysis of the results showed good correlations between  $EC_a$  and various nutrients including nitrate-N available phosphorus and potassium. Figure 2 and Figure 3 below show the predicted distribution of nitrate-N and Colwell phosphorus respectively. There is a clear pattern of elevated nutrient levels between the shelter (shed) and the feed area and wallow. Nutrient levels in these hotspot areas were up to six times higher than the mean concentrations for the whole paddock.

**Figure 2. Predicted Nitrate-N Distribution Map**



**Figure 2. Predicted Colwell Phosphorus Distribution Map**





Rotational outdoor piggeries will always accumulate nutrients in the soil because the mass of nutrients brought onto the area with feed exceeds the mass exported in pigs.

EM surveying has proven to be a useful tool for identifying elevated nutrient levels, and particularly hot spots, in rotational outdoor piggeries.

Overall, the results for the EM survey indicate that nutrients can accumulate to very high levels, and confirms that nutrients are not evenly distributed in these piggery systems. Regularly relocating shelters and feeding areas to change the dunging pattern will promote more even distribution of nutrients across the paddock.

**Photo 2. Free Range Piggery Hut**



## References and Further Reading

Australian Pork Ltd 2013 (revised) National Environmental Guidelines for Rotational Outdoor Piggeries, Australian Pork Ltd, Deakin.

Wiedemann SG 2014 Tracking Nutrients in Outdoor Piggery Systems, Final Report of Australian Pork Ltd Project 2011/1011.416, Australian Pork Ltd, Deakin.

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