FARM ENVIRONMENTAL IMPACT
- A LABORATORY MODEL TO HELP FARMERS UNDERSTAND AND MITIGATE THEIR ENVIRONMENTAL FOOTPRINT

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Abstract
The introduction of nutrient and environmental management plans for farming systems has the potential to mitigate nutrient losses and nutrient enrichment of surface waters at the farm and catchment scale. The more recent interest by individual farmers in measuring the positive effects of their own farm plans has prompted ARL to introduce a Farm Environmental Impact suite of water tests. The principle of the model is the periodical assessment of surface water quality both entering and exiting the property. Assessment is against established threshold levels for measurands (pH, NH_4-N, NO_3/NO_2-N, DRP, Turbidity, Total Coliforms and *E.Coli*) and their likely impact on periphyton proliferation and other aesthetic values of rivers and streams.

Introduction
The Ministry for Primary Industries (MPI) target for a doubling of primary exports by 2025 will place a heavy responsibility on the agricultural sector to control associated environmental impacts. Regional councils through their communities are vested with setting the framework for maintaining or enhancing the natural, recreational and human use values of surface waters. Until more recently, the measurement of the affects of farm enterprises on water quality has been targeted towards baseline measurements at the catchment scale. The recent introduction of Plan Change 6A (Water Quality) by the Otago Regional Council (ORC) places the onus of controlling contamination on the land user. ORC limits will be assessed using the OVERSEER nutrient budget model for nitrogen losses and by water analysis. In an effort to help land managers understand the impact their farming operation is having on surrounding surface waters ARL has developed a sampling kit, sampling protocol and analytical service which meets best laboratory practice. Results presented in chart form are benchmarked against the ANZECC (ANZECC, 2000) guidelines for freshwater quality showing compliance or non compliance at a glance.

Sampling Protocol
Prior to sampling it is recommended land managers develop farm paddock plans based on topographical maps or aerial photographs detailing permanent waterways and ephemeral streams entering and exiting their property. These entry and exit points become the permanent sampling locations for ongoing water quality assessments. For reporting results, clients are asked to ensure sample names for each sample point are kept for all sampling occasions. This allows the laboratory to trend results over time. Four samples are recommended annually, comprising spring, summer, autumn and winter, with sampling times to coincide with mid flow levels, avoiding very low and high flow conditions.

A kit system is provided by the laboratory containing submission form, detailed sampling instruction booklet, contaminant free and sterile containers, freezer aids and a return addressed chillybin. Samples are carefully taken from mid flow by partially submerging the container and allowing the water to fill the container without disturbing the sediment. Samples are securely capped and packed with the freezer aids into the chillybin for immediate dispatch to the laboratory. Clients are encouraged to take samples earlier in the week to ensure they arrive well before the weekend.

Laboratory Analysis

On receipt samples are analysed for pH, ammoniacal nitrogen (NH_4-N), nitrite and nitrate nitrogen (NO_3/NO_2-N), dissolved reactive phosphorus (DRP), Turbidity, Total Coliforms and *E.Coli*. Analytical methodology for each of these measurands is based on Standard Method for the Examination of Water and Wastewater (2010).

It is accepted that the bacteriological samples will exceed the recommended time elapsed between sampling and analysis, however several studies (Pope et al 2003 and Crump, 2011) have shown that samples kept below 18ºC for up to 72 hours show similar values to those analysed at time zero.

Analytical Reports

Results are reported in tabular format (Figure 1) and the concentration of each measurand is also charted using a logarithmic scale. For easy assessment, the coloured chart shows the concentration for each data point and a solid line at the NZEEC trigger values. These reports are continuously updated with results from subsequent sampling occasions (Figure 2). At this stage the charts are only annotated with the NZEEC Guidelines levels. The ORC Plan Change 6A introduces different limits based on catchment classification (Receiving Water Group 1 – 4), so the laboratory will explore annotating with these limits in future.

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Service Person:
Name:
Email:

Customer No: 1234568
Samples Received: 30/08/2013
Report Issued: 31/01/2014
Total samples: 2
Order Number: WATER 30AUG2013

60856218-WATER 30AUG2013

WATER ANALYSIS FOR ENVIRONMENTAL IMPACT

Sample Name	Date & Time Sampled	Lab Number	Temp. on Receipt oC	Ammoniacal Nitrogen mg/L	Dissolved Reactive Phosphate-P mg/L	E. coli MPN/100 mL	Nitrate-Nitrogen mg/L	Total Coliforms MPN/100 mL	Turbidity NTU	pH
Sample 1	28/08/2013 10:35 AM	1038547	9.3	0.181	0.009	109	0.13	201	1.84	6.49
Sample 2	28/08/2013 10:45 AM	1038548	9.1	0.121	0.011	118	0.09	201	1.50	6.29

Figure 1. Report format

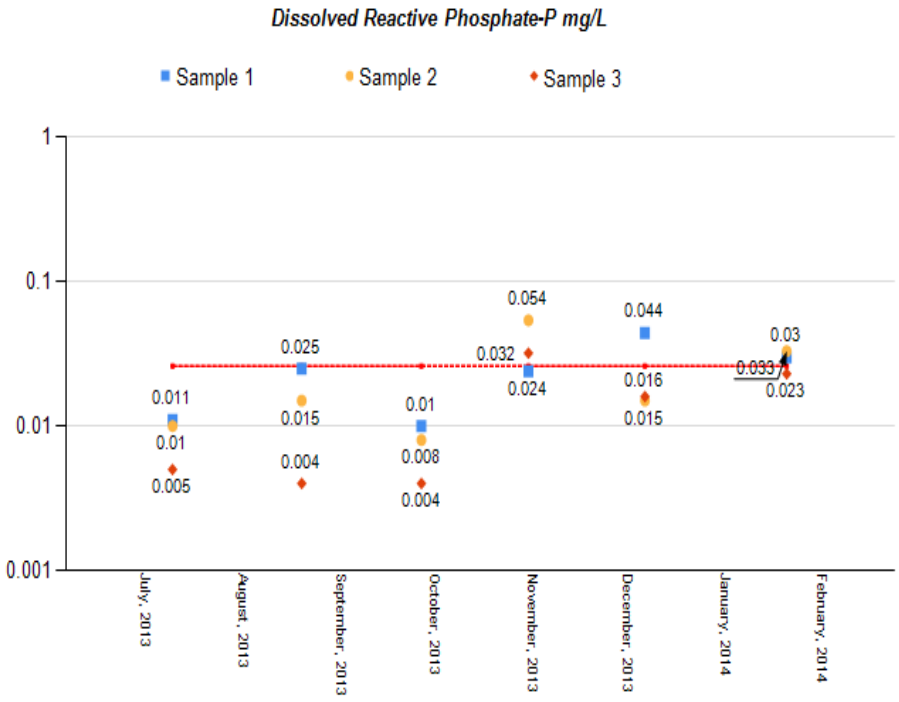

Figure 2. Updated results from subsequent sampling occasions

Conclusion

Land managers have a convenient kit and detailed instructions for taking surface water samples and submitting them to the laboratory for analysis. The test suite has been chosen to include the key measurands for determining land use environmental impacts on recreational and human use values of surface waters. The report of analysis allows clients to assess environmental performance against key trigger levels over time and to measure the effects mitigation strategies are having on surface water quality.

References

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Ministry for the Environment website: Water Quality in Selected Dairy Farming Catchments: A baseline to support future water-quality trend assessments The Australia and New Zealand Environment and Conservation

The Australia and New Zealand Environment and Conservation Council guidelines for fresh water quality (ANZECC, 2000)