BEFORE THE CANTERBURY REGIONAL COUNCIL

In the matter of	the Resource Management Act 1991 ("**RMA**")
And	
In the matter of	Proposed Canterbury Land and Water Regional Plan
Between	**the New Zealand Institute for Plant & Food Research Ltd ("P&F")** Submitter
AND	**Canterbury Regional Council**

EVIDENCE OF WILLIAM GRIFFIN

2nd APRIL 2013

PERSONAL DETAILS

1. My full name is William Biss Griffin, although I am commonly known as Bill. I hold BSc (Hons) and PhD degrees in applied genetics biology from the University of Canterbury, New Zealand, and Cambridge University, United Kingdom, respectively.

2. I am currently Breeding & Genomics (B&G) Portfolio Manager, at Plant & Food Research (P&F), Lincoln. I provide a supporting role to the B&G General Manager, who is based in Auckland, including responsibility for the operation of all the Plant & Food Research orchard, farm and glasshouse resources. The B&G Portfolio includes science activities from basic functional genomics, through the development and application of genetic technologies, to applied breeding programmes for a range of horticultural, vegetable and arable crops. Our orchard, farm and glasshouse operations are critical enabling services in support of these science activities. The portfolio totals approximately 230 staff in 11 of the 14 P&F sites spread from Northland to Southland, including 5 orchard sites, 4 farm sites and glasshouse facilities at 12 sites.

SCOPE OF EVIDENCE

3. I have been asked by Plant & Food Research Ltd (P&F) to provide technical evidence about the operations of P&F, in order to understand the potential impact that proposed changes to the Land and Water Regional Plan could have on these operations, particularly in relation to the proposed rules for Canterbury arable farming which will require an annual environmental plan, including nutrient budgets prepared by a suitably qualified person and informed by a nutrient model such as Overseer™. The scope of my evidence is outlined as follows:
    - General overview of P&F
    - Overview of activities undertaken on the farm research blocks generally
    - Specific activities undertaken that are individually “unmanageable” by nutrient models, including Overseer™.

GENERAL OVERVIEW OF PLANT & FOOD RESEARCH OPERATIONS

4. P&F is a New Zealand-based science company formed in December 2008 through the merger of HortResearch and Crop & Food Research. Our mission is scientific discovery and innovation to grow prosperity, health and sustainability from New Zealand's food plants and seafood resources. Our research will support the growth, profitability and sustainability of associated horticulture, arable, seafood and processed food industries; and contribute to Government responsibilities related to these industry sectors, for example in areas of biosecurity, land use decisions, environmental impacts and export market access.

5. To achieve national benefit in these areas we have structured our science within five major portfolio areas: breeding of new and improved food plants with premiums creating competitive advantage; plant production, harvesting, processing and supply that is economically and environmentally sustainable; control of plant pests and diseases, including biological and environmentally-based control methods; innovative plant based foods that meet consumer needs; and seafood production, harvesting, processing and supply that is economically and environmentally sustainable. We maintain research centres at 14 sites across New Zealand so that all regions of national significance to our industry sectors are covered, and we maintain nationally significant capability and collections and databases (such as custody of the National Collections of Fruit Crop Germplasm and the Arable Crops Genebank).

6. P&F have significant assets and operational interests in land within the Greater Christchurch area and the Canterbury Region, particularly in Lincoln. The Research Campus at the

Canterbury Agriculture and Science Centre is located on the north side of Gerald Street in Lincoln Township. P&F own and lease additional landholdings used as research blocks in the immediate surrounding rural area.

OVERVIEW OF ACTIVITIES UNDERTAKEN ON RESEARCH BLOCKS

7. The field activities undertaken on these Lincoln area research blocks include new vegetable and arable crop breeding programmes; specialist pure-seed production of associated advanced breeding materials and released commercial cultivars; agronomic and modelling trials for optimisation of crop production; multiplication and selection nurseries for arable crops of northern hemisphere breeding companies; and commercial arable and vegetable cropping production trials. These activities involve scientifically designed plot sizes, position, and replication; from individual precision-spaced single plants, to commercially seeded blocks of several hectares. Annually, approximately 60h of such experimental plots are planted, amounting to 100's of thousands of individual plots, as demonstrated in the photograph of our breeding plots below. Specialist small-scale planting and harvesting equipment is required to operate the trials and nurseries, including a significant component of hand-maintenance and harvesting by expert staff.

8. This farm activity is overseen by a Farm Users Board (FUB), including representatives of all the farm PFR research teams, the Lincoln Farm Manager and a farm staff representative. All issues regarding planning of future activities and approach, best farming-practice management, and farm resource input planning, prioritisation and allocation are discussed and collectively agreed. Any particular concerns regarding environmental impact of planned experimentation would be addressed by the FUB and an acceptable approach, including modification of experimental design, agreed.

Breeding plots, PFR, Lincoln

9. Precision irrigation and agro-chemical management is required across the whole area, with variable inputs according to the nature of the scientific enquiry. Generally the breeding plots receive standard water and nutrient inputs, but minimal disease protection so that genetic disease resistances can be determined. Within the agronomic and modelling crop production trials however, these inputs are often deliberately extended beyond the normal range of acceptable best-practice, both below and above standard rates to meet crop demand. This includes different fertiliser (nitrogen, phosphorus, etc), irrigation and agrochemical rates allowing the full range of soil, plant and cropping system responses to be determined. The knowledge gained from these studies is used to develop integrated soil, crop, water and

nutrient management models and on-farm decision support tools that are aimed at improving the economic and environmental sustainability of different agricultural production systems. These include the establishment of best practice guidelines for farmers and industry groups and the setting of environmental limits used in regional policy development (e.g. those needed to successfully complete Environment Canterbury's "Look Up Table" (LUT) project) and compliance monitoring.

10. Thus, this ability to deviate from best-practice is critical to our work in general and is essential to establishing the evidence that is needed to set critical limits for nutrient losses to ground water and in run-off.

11. Precise comparison between treatments and plant types requires minimisation of environmental variability, so soil type and range, ground preparation, management inputs and harvesting must all be standardised and delivered uniformly across the whole blocks. Experiments and projects that require variable inputs are therefore carefully planned to minimise creating lasting, long-term variation in soil physical or nutrient within-block variation. A 5-year rotation across our cropping blocks, involving cereals, legumes and 2 years of restorative forage grass species, is followed to ensure that within-block variability is reduced as far as possible and good soil properties are maintained. If the input treatments are considered extreme, then the FUB would discuss and perhaps recommend the project be conducted on land outside our normal cropping rotation.

12. Since 2000 P&F has monitored the soil quality across its whole research farm in late summer/early autumn using the P&F Soil Quality Management System (ref). This has allowed a detailed picture of soil quality changes over time that includes soil Total N% and Water Storage (% g/g) at 15cm depth. This monitoring allows the P&F Farm Manager to monitor the impact of various farm management practices on the soil physical conditions of our research blocks over time and the mitigating influence of the 5-year rotation operating. Although the physical soil quality parameters of many of our research blocks is not high, due to its very long history of almost continual cropping and the relatively recent introduction of the restorative forage grass rotation components, the nutrient and water quality parameters are generally close to, or above optimum recommended values.

SPECIFIC ACTIVITIES UNDERTAKEN THAT ARE "UNMANAGEABLE" BY NUTRIENT MODELLING SUCH AS OVERSEER™

13. Nutrient models such as Overseer™ are "whole of farm" tools designed to predict nutrient cycling over time on a broad area scale. P&F has used the above experimental approach within our research blocks to undertake contracted research contributing to the development of such models, including Overseer™, for nutrient management on Canterbury arable farms. Our experimental farm blocks comprise small, variable input plots of different crop types, sometimes overlaid with different tillage intensities and crop residue (stubble) management treatments, as demonstrated in the photograph of a forage production trial below. The research plans and approaches vary significantly from year to year, depending upon the research needs of our major end-users, including Environment Canterbury. Determining paddock scale entries into Overseer™ based on such variable small plot trials will be exceptionally difficult – ideally requiring soil nutrient measurements from each plot receiving a different treatment. Normally each field is assessed by taking 12-15 soil samples along a transect (see section 12 above). The numbers of plots receiving variable inputs varies from year-year depending on science objectives and funding, but the additional requirement to sample every one of these plots would multiply this current soil monitoring activity by at least an order of magnitude, requiring unreasonably large-scale and detailed soil

measurements and staff time commitment. Also, because Overseer™ relies on annual average climate conditions, predictions of losses from highly variable treatment plots that change from year to year will be meaningless.

Pasture 21 forage production trial, PFR, Lincoln

14. The proposed rules require an annual nutrient budget to be prepared by a suitably qualified person and informed by a nutrient model such as Overseer™ for each identified "land management unit" and the overall farm. As outlined, our research farm is comprised of many research components with significantly different farming input treatments. For the majority of our farm, although the breeding crop materials will vary from plot to plot, the management inputs are standardised to minimise the between plant and/or plot variation. Some of our farm blocks and/or fields have varying soil types and could be reasonably classified as different land units, but applying a nutrient model as an extension of our current soil quality monitoring process, see section 12 above, would be manageable.

15. However, for the component of our effort which requires deliberately varying management inputs, see above, the definition of "land unit" becomes crucial. If we are required to account for each individual research plot under such a definition, then as outlined above in section 15, informing any nutrient model would at best be extremely onerous to apply on our research farm, and at worst provide meaningless information. Under this definition we could not conduct our research programme in a cost-effective manner, ironically often in support of the development of nutrient management models being used to set the critical limits that will be imposed under these proposed rule changes. If though, we are able to average these variable inputs across a more broadly defined land unit based on similar soil type, then once again, as for the breeding plot areas, applying a nutrient model as an extension of our current soil quality monitoring process would be manageable.

CONCLUSIONS

16. P&F undertakes research activities that play an important national role that adds value to fruit, vegetable, crop and food products. Our existing soil quality monitoring programme indicates that the rotation and general farm management we apply on our research farm, including areas of highly variable management inputs, is improving soil physical conditions across our farm that are expected to reduce the risk of detrimental effects on the

environmental, including nitrate leaching. The application of any nutrient model to our research farms is entirely dependent upon the definition of "land unit", which currently is open to interpretation.

17. Given the above, it is my opinion that an exemption from the research activities is justified on our research arable farm. If this is not achievable, then the definition of land unit must allow us to classify our research farm by soil type and average management inputs, by space and time, in order to allow us to reasonably produce an environmental plan, including nutrient budgeting.