In the matter of: Clauses 6 and 8 of Schedule 1 – Resource Management Act 1991 – Submissions on publicly notified plan change and variation – Proposed Plan Change 1 and Variation 1 to Waikato Regional Plan – Waikato and Waipa River Catchments

And: **Wairakei Pastoral Ltd**

Submitter

And: **Waikato Regional Council**

Local Authority

Supplementary evidence of Nicholas Ashley Conland

Dated: 25 March 2019

SUPPLEMENTARY EVIDENCE OF NICHOLAS CONLAND

SUMMARY AND CONCLUSIONS

1 My supplementary evidence has been prepared in relation to expert witness conferencing on Table 3.11-1 in Plan Change 1 to the Waikato Regional Plan for the Waikato and Waipa River Catchments (**PC1**).

2 My observations and understanding of river and stream water quality as a dynamic balance of daily respiration and chemical equilibrium is not represented in the proposed attributes and levels for the PC1 ecosystem indicators and particularly the method for determining these objectives, targets and limits.

3 The use of recent monitoring data as a screening tool for current state is appropriate and good practice. The extension taken by CSG to make use of these data as freshwater objectives is problematic.

4 The attribute levels need to include the statistical variance brought about by:

a) Data collection programming;
b) Measuring biophysical systems;
c) Technical sampling and lab analysis;
d) Changes to current and future land use; and
e) Climate and seasonal variability.

5 The primary concern with the Table 3.11-1 is how to understand when the Freshwater Objectives are exceeded via a ‘downward trend’ of deteriorating water quality. This problem within the plan can be resolved through including as much of the known uncertainty within the attribute levels.

6 The inclusion of estimated statistical variance in the Freshwater Objectives for the selected attributes will reduce false positives or negatives in water quality trends, i.e. when the actual observations are within the variance expected in water quality measures.

7 The regulatory programme required to implement the proposed Table 3.11-1 within PC1 will function when the table provides clear guidance with a minimum level of complex interpretation or expert opinion.

8 The inclusion of appropriate Limits and Targets as a “load” to limit the level of resource use in the catchment is an appropriate tool to guide resource managers to meet the Vision and Strategy Objectives and provide for the Values in PC1.

9 An assessment of Limits and Targets for the TP and TN attributes in the 10 Ruahuwai sub-catchments in the Upper Waikato FMU has been undertaken and a complete range of limits proposed. This exercise could easily be completed for each of the sub-catchments in Table 3.11-2

10 The introduction of Limits and Targets (as loads) on TN and TP into PC1 to manage resource use on land has advantages such as:

10.1 The interannual variation is limited;

10.2 The integration with flow of a load reduces sample bias; and

10.3 Provides an independent budget for resource use.

11 The existing sub-catchment scale within Table 3.11-1 supports the management of the Waikato and Waipa Rivers to achieve the Vision and Strategy. The inclusion of the proposed monitoring points is likely to improve the proposed direction of travel by focusing the community of the areas of the whole catchment which require mitigations and practice changes.

12 Given the known variance in the monitoring data, the uncertainty of future states for water quality; and the lack of comprehensive data for some attributes, in some locations, it may be appropriate to include Freshwater Objectives as the National Objective Framework ‘Band’ (i.e. B band for TN) to represent the desired states for each of the proposed time periods in Table 3.11-1.

EVIDENCE

BACKGROUND

1 My full name is **Nicholas (Nic) Ashley Conland**:

1.1 I have been engaged by Wairakei Pastoral Limited (**WPL**) since 2015 to manage the Natural Resources division of the company in relation to the Wairakei Estate on a part-time basis; and

1.2 I am also the Director and lead resource scientist for my own environmental consultancy, Taiao - Natural Resource Management Limited.

2 Until mid-July 2015 I was a Senior Environmental Consultant at Jacobs New Zealand Limited in Wellington for 7 years. I have at least 17 years' experience involved in natural resource planning and regulation, including assessment of environmental effects and catchment modelling.

3 I have a Bachelor of Science (Chemistry, Information Systems), Waikato University, Hamilton; a Diploma of Design (3D), Waikato Polytechnic, Hamilton; and a Post Grad Certificate of Proficiency (Environmental Planning and Law), Victoria University, Wellington.

4 Since 1995 I have participated in the collection, analysis, interpretation and development of water quality monitoring programmes for many organisations.

5 I have attended numerous Regional Plan Change Hearings and Environment Court mediation sessions as an expert witness. I have prepared evidence for Boards of Inquiry and prepared and presented expert evidence for the Environment and District Courts.

6 Of particular relevance to this hearing is my recent experience in expert caucusing for the proposed Gisborne Freshwater Plan (2017-18), where similar issues relating to freshwater objectives, limits and targets were considered for a range of attributes under the National Policy Statement for Freshwater Management (**NPS-FM**).

7 Since 2010, I have undertaken catchment-based modelling to determine the effectiveness of policy and planning proposals. Including managing the design, development and preparation of the Tukituki SOURCE Model, for the Tukituki Plan Change 6 and Ruataniwha Water Storage Scheme, and the Selwyn Waihora

SOURCE Model, for the Variation 1 Plan Change Central Plains Community Water Scheme.

8 I prepared the design and scope for the Ruamahanga SOURCE model (GWRC) and I am currently managing the design, development and preparation of the Ruahuwai SOURCE Model for WPL.

9 I prepared the design and undertook practice reviews for the Waipaoa River SOURCE model (HortNZ) and developed the scenarios for the model to test the responsiveness of the natural systems to changes in the catchment land use.

10 I am providing guidance and technical advice to Bay of Plenty Regional Council for the design, development and application of the Kaituna-Pongakawa-Waitahanui and Rangitaiki catchment models (BoPRC). These models are being used to explore a natural resource framework under the NPS FM for Plan Change 12 and I have presented evidence from flow scenarios relative to these models for Plan Change 9.

11 My evidence has been prepared in accordance with the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2014.

Focus of my supplementary evidence

12 My supplementary evidence prepared in relation to expert witness conferencing on Table 3.11-1 in Plan Change 1 to the Waikato Regional Plan for the Waikato and Waipa River Catchments (**PC1**) will cover the following matters:

12.1 Freshwater Objectives for Ecosystem Function;

12.2 The use of monitoring data for Freshwater Objectives;

12.3 Implementation of Table 3.11-1;

12.4 Inclusion of Loads as a Limit or Target under the NPS FM in PC1;

12.5 Structure of Table 3.11-1; and

12.6 Conclusions.

Freshwater Objectives for Ecosystem Function

13 I have undertaken monitoring for many freshwater attributes in Sub-catchments, 74 (Pueto), 66A (Tahorakuri) and 73 (Ohaaki).

14 As part of these studies I have observed the diverse temporal and spatial ranges for ecosystem attributes.

15 Notably the ranges for pH, Dissolved Oxygen (**DO**) and Temperature all vary (somewhat independently) within a daily cycle. This is an expression of the instream metabolism as both respiration and chemical demand. Photosynthesis during the day provides a peak oxygen level (usually in early afternoon) and biological demands provide a minima (usually in the hours before midnight) each day.

16 The following plot from the Pueto Stream provides an illustration of the typical range for these attributes across a recent 24-hour period.

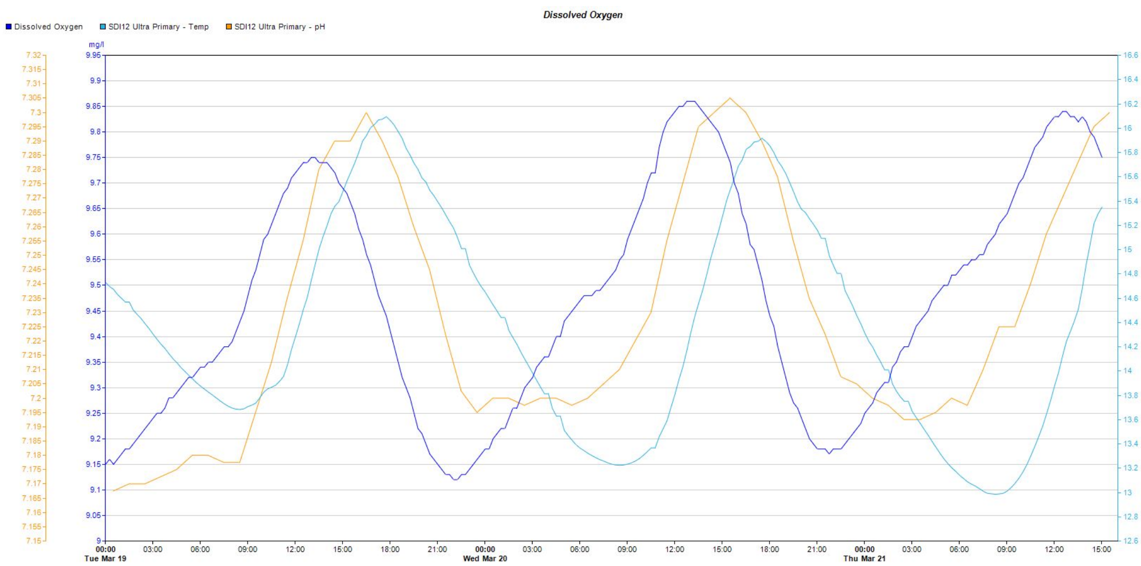

Figure 1: Monitoring on the Pueto Stream

17 The range and balance for these attributes is proportional to the biological activity, where the range between the daily peaks for DO signifies stream health, a large gap is a deteriorating or stream with poor health. Ie the Pueto with a range less than 1 is in excellent health.

18 As such DO provides a simplistic measure for determining ecosystem health.

19 To include these attributes in Table 3.11-1 requires sites to have continuous monitoring to provide accurate measurements that are inclusive of daily and seasonal variability.

20 For example Dissolved Oxygen (below point source) in the National Objectives Framework has a suggested approach as:

20.1 The mean value of 7 consecutive daily minimum values; and

20.2 The lowest daily minimum across the whole summer period.

21 Should attributes for Dissolved Oxygen, pH or Temperature be adopted a similar approach for data collection and attribute representation would be required.

22 I have also undertaken assessments for MCI within the Ruahuwai sub-catchments in the Upper Waikato River Freshwater Management Unit (**FMU**) and support the evidence of other experts who note that special attention and consistent methodologies are required for soft bottom streams.

23 I further note that riparian management appears to have a strong influence on MCI scores.

24 In the Ruahuwai Catchment where: there is stock access; the banks are frequently inundated; prone to flooding; or erosion, the ecological communities are poor.

The use of monitoring data for Freshwater Objectives

25 I support the evidence of Dr Neale (para's 41-86) and his detection of numerical errors in the data preparation and presentation.

26 In my experience the use of monitoring data for current state is useful and appropriate for determining the baseline position for attributes in the existing water quality.

27 There is a systematic difficulty however when using historical sampling data both to predict the future state or to determine freshwater objectives, Limits or Targets, without an appropriate DST.

28 This is due to the internal variation in the data due to a range of factors.

29 In my experience the data collected from monitoring programmes is subject variability from the following influences:

29.1 Data collection programming;

29.2 Measuring biophysical systems;

29.3 Technical sampling and lab analysis;

29.4 Changes to current and future land use; and

29.5 Climate and seasonal variability.

30 Each of these influences can either individually or in combination affect the individual samples taken during a monitoring event.

31 I have previously presented evidence on this for the recent Gisborne Freshwater Plan hearings 'Water Quality Chapter' on 28 November 2016.

32 As similar principles apply, I have reproduced in part my previous Gisborne evidence para 91 below:

91 The number selection process can be simply described in two key principles which are applicable to the FMU attributes:

91.1 Uncertainty of Measurement

91.2 Significant Figures

92 The Uncertainty of Measurement is well described by the Hill Laboratories Technical Note[1] in the following paragraphs:

92.1 "We hope that this doesn't surprise you but if we carry out ten analyses on the same sample, we will not get ten identical results. The results produced will vary slightly each time due to slight variations in testing conditions, such as equipment, the technicians carrying out the test, or the environment.

92.2 In the laboratory, we call this "Uncertainty of Measurement" or "UoM" for short. We have regular controls to measure the UoM for a test and we actively try to remove as much variation as best we can, but the variation in any analytical process will never be zero.

92.3 A common reason for testing is to ensure limiting values are not exceeded. Without knowing the UoM, it may seem easier to make decisions, but these decisions may be incorrect and lead to undesired

[1] Hills Technical Note: Uncertainty of Measurement Version 2

outcomes. Therefore, it is important match the analytical method's capability with the limit or critical value under consideration."

93 To apply the UoM to the attribute levels requires an individual assessment for the uncertainty in the analytical techniques to the applied. This can be undertaken by looking at the cumulative error in the analytical method steps. A pragmatic approach to applying the UoM is to use the detection limits in the test results.

94 I have used a multiple (either 10 or 5 times the detection limit) of the test detection limit for interpreting analytical results since 1995. The application of the detection limit to the UoM is neatly considered in another Hill Laboratories Technical Note[2] in the following paragraphs:

94.1 "Choosing the right method for the purpose is important as it ensures that the most appropriate results are obtained at the best price. Typically, the lower the detection limit, the more difficult, complex and therefore expensive the testing is.

94.2 When testing against a regulatory or critical limit, the detection limit needs to be sufficiently lower than this value to ensure that a meaningful and valid result can be obtained; ideally ten-fold below the regulatory limit."

95 HortNZ is recommending that the attribute levels be examined to see whether they are greater than 10 times the detection limit for each of the attributes in the FMU.

96 For the analysis completed in my evidence a UoM is based on a value equivalent to ten times the limit of detection. An exception is made for this assessment being within the NOF framework.

97 The next key element is the number of significant figures in the attribute levels. The purpose of the significant figures is to ensure that the levels applied for each attribute limit don't have a 'tail' of numbers that imply an accuracy, which doesn't exist. This tail of significance needs to be cut off to a level to comply with the UoM.

98 I suggest these simple principles for significance and uncertainty are required for the attribute levels in the limit's tables for each FMU.

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[2] Hill Laboratories Technical Note: Detection Limits

99 The retrospective fitting of these principles to the attributes raises their validity and the long-term durability as a regulatory framework.

100 The following table is produced from a recent report containing Hill Laboratory detection limits. The table lists a range of analyses typical for SOE monitoring. The second column contains the detection limits; the third column contains the estimated UoM for each of the analytes. The units are all ppm except for E-Coli that is in cfu/100ml.

Table 1 : Assessment of UoM for range of Attributes

Attribute for analysis	Default Detection limit	Uncertainty of Measurement
Turbidity	0.05	0.50
TSS	3	30.00
TN	0.05	0.50
Ammoniacal-N	0.01	0.10
Nitrate	0.001	0.01
DIN	0.002	0.02
TKN	0.1	1.00
DRP	0.004	0.04
TP	0.004	0.04
E-Coli	1	10.00
Chlorophyll A	0.003	0.03

31 In summary I recommend that an UoM is applied when determining the numeric levels for the attributes in Table 3.11-1. I also support the approach of Doole et al (2016), and Dr Neale (para 80) to use two significant figures for the Freshwater Objectives, Targets and Limits.

32 To avoid the inclusion of either unworkable attribute levels; or Freshwater Objectives where current monitoring of the attributes levels falsely indicates a decline in water quality; the attributes need to be inclusive of both explicit and implicit variability.

Implementation of Table 3.11-1

33 I am concerned with the "next band up" approach from the Collaborative Stakeholder Group (**CSG**) described in the evidence of Dr Ausseil on behalf of the Waikato and Waipa River iwi (para's 55, 95-104), which has been used to determine the 80-year Freshwater Objectives because this has unintentionally

marginalised the Upper Waikato River FMU by setting Sub-catchment 64 (Waipapa) with a desired state objective which requires a 54.3% reduction in TN.

34 In my experience there are several methods to set the numeric levels for attributes under the NPS FM to give effect to community values.

35 While in practice most are used in combination, these could be summarised as:

35.1 Levels based on a key attribute such as periphyton;

35.2 Levels based on estimated levels of resource use and mitigations;

35.3 Levels based on protecting an important natural ecosystem (such as an estuary); or

35.4 Levels based on an aspirational target.

36 I believe that PC1 has developed the numeric levels in Table 3.11-1 using the fourth method.

37 The implementation of Table 3.11-1 requires an exploration of the likely consequences and the potential bias where upriver sub-catchments are influenced by the natural background inputs such as geothermal inputs.

38 The natural background and loads are summarised in the Waikato Regional Council Technical Report 2014/56[3] (Vant 2014) as follows:

> "Naturally-occurring processes within the catchments also contribute to the nutrient mass flows in the rivers; and these processes would have operated prior to human development of the catchments. About one-third of the current mass flows of both nutrients is estimated to be due to these natural or ―background‖ processes. A proportion of the mass flows from land that has been developed by people can be regarded as natural and essentially un-manageable."

39 By looking at the loads as a conservative indicator of resource use and mass flows carried by the Waikato River in the Upper Waikato River FMU an analysis of the proposed Freshwater Objective can be applied.

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[3] Vant B, *Sources of nitrogen and phosphorus in the Waikato and Waipa Rivers, 2003–12* (Waikato Regional Council 2014), [page 11]

40 Vant (2014) reports in the mass flows of nitrogen and phosphorus in the Waikato River catchment during 2003–12 in Table 5, these provide a useful outline for the proportionate loads in the Upper Waikato River FMU.

41 Table 5 cites the overall load as being 3623 (t/yr) and the land use component as being 1604 (t/yr). A simple calculation shows that a 54% reduction of the overall load is 1656 (t/yr).

42 Following the logic of the Table 5 we then remove the background (1453 t/yr) and the inflow from Lake Taupo (339 t/yr), this leaves us negative 136 t/yr before any contribution from Point Sources has been considered.

43 This stark example demonstrates the unintended consequences of applying a "next band up" narrative rather than a numeric approach to the NPS FM process.

Inclusion of Loads as a Limit or Target under the NPS FM in PC1

44 As noted above the use of a load is a conservative numeric approach to setting a target or a limit under the NPS-FM.

45 Where a load is calculated for an attribute as the integrated sum of the flow (volume over time) and the concentration (mass within volume) the units for a load are therefore mass over time.

46 A load provides the flow proportional estimation of the sources of an attribute in a river system and a useful part of a freshwater quality accounting system under the NPS-FM.

47 As outlined in the EIC of Dr Neale for WPL (Including the evidence of Ms Holmes for HortNZ at para 31-59; and Dr Cox for Beef and Lamb at para 74) a load for TN and TP can be used to constrain the main sources of plant nutrients (Rutherford et al 1987[4]) both from surface water runoff, point sources and diffuse discharges from land use activities.

48 I agree with Vant 2014 that unlike other attributes TN and particularly TP are "quasi-conservative" attributes within a river

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4 Rutherford JC, Williamson RB, Cooper AB 1987. Nitrogen, phosphorus, and oxygen dynamics in rivers. In: Viner AB (ed.), Inland Waters of New Zealand. DSIR Bulletin 241. Wellington, Department of Scientific and Industrial Research. pp. 139–165.

system. This contrasts with other attributes sometimes suggested such as bacteria and ammonia.

49 This creates some advantages for Limits and Targets (as loads) on TN and TP to manage resource use on land such as:

49.1 The interannual variation is limited;

49.2 The integration with flow of a load reduces sample bias; and

49.3 Provides an independent budget for resource use.

Structure of Table 3.11-1

50 I support the importance of Table 3.11-1 providing Freshwater Objectives to achieve the NPS-FM and the Vision and Strategy and as a framework for a Freshwater Accounting System to support the implementation of PC1 by Waikato Regional Council (**WRC**) and the community.

51 Table 3.11-1 is a useful method to support the other provisions in PC1, but to do this it needs to consistently apply the same approach to all of the sub-catchments. I agree and support the EIC of Dr Neale (para 79) that an attribute and the numeric level for the Freshwater Objective, Target or Limit is set according to the SMART principles.

52 In my experience it is easier to manage a natural system if there are increased points of observation. In a similar way it is easier to manage a problem before it gets too large. As such I both support the existing sub-catchment scale of information in Table 3.11-1 and the inclusion of TP and TN at the sub-catchment scale.

53 The implication in the Section 42A Report at para's 137, 142,143 and 487 that the river is an indivisible unit is true in both the metaphysical and physical sense – but is not appropriate or practicable in a resource management context where both the sub-catchments and whole river are equally important in delivering overall river health.

54 For example each of the sub-catchments in Table 3.11-1 has individual 80-year Freshwater Objectives. In practice when each of these are reached that sub-catchment has arrived at the Vision and Strategy. Again, when a majority of the sub-catchments have reached their 80-year Freshwater Objectives the majority of the river will have arrived at the Vision and Strategy fulfilling the Values and Objectives.

55 It's not conceivable that a sub-catchment will have to continue to improve once it has reached the relevant Freshwater Objectives for

the Vision and Strategy. I accept that people and communities will have to actively maintain the status it has achieved (via regularly updated Farm Environment Plans and mitigations) but not to continue to reduce for instance the catchment load.

Conclusions

56 The requirements for monitoring complex ecological conditions for water chemistry require continuous monitoring. To undertake this monitoring at 75 sub-catchment sites this would require considerable resources.

57 The current observation data is useful for understanding the historic trends, however it is a poor indicator for future freshwater states.

58 All freshwater monitoring data is subject to variability. To overcome this the attribute levels need to include explicit and implicit variability.

59 The CSG adopted approach for "next band up" selection for attribute levels is transparent and easy to adopt, however it has introduced a concern for the Upper Waikato FMU which contains a significant background load from its natural geology.

60 The introduction of Loads and Targets to Table 3.11-1 will provide a more certain method for developing a Freshwater Quality Accounting System to achieve the Vision and Strategy.

61 The structure of the Table 3.11-1 introduces 74 opportunities to manage the natural resources within the Waikato and Waipa Awa. The frequency of these observation points on the water quality will allow the community, iwi and WRC to target and focus their efforts in a stepwise way to achieve the Vision and Strategy.

Nicholas Conland

Director, Taiao - Natural Resource Management Limited

25 March 2019

Nic Conland

QUALIFICATIONS

Bachelor of Science (Chemistry, Information Systems), Waikato University, Hamilton

Diploma of Design (3D), Waikato Polytechnic, Hamilton

Post Grad Certificate of Proficiency (Environmental Planning and law), Victoria University, Wellington

CURRENT POSITION

Natural Resource Science and Policy

SPECIALIST FEILDS

- Strategic Science Planning
- Catchment Hydrology
- Catchment modelling
- Water Quality
- Technical Review of Resource Consents

PROFESSIONAL MEMBERSHIPS

- Associate member NZPI
- New Zealand Hydrological Society
- New Zealand Freshwater Science Society
- Environment Institute of Australia and New Zealand (EIANZ)

Summary of competencies

Nic has 20 years' experience in the environmental assessment field being involved in both the preparation and review of water quality effects assessments and in managing, reviewing and reporting on water quality monitoring programmes.

Nic has extensive experience in land use change assessments and determining catchment effects on groundwater and riverine systems for large primary sector operations; roading infrastructure; landfills, urban development and storm water where a long-term whole-of-catchment environmental assessment is required to provide solutions for staged works over many years. These projects, with a focus on performance management utilising adaptive management frameworks for freshwater monitoring to ensure sustainable resource management, include experience in the policy, planning and legal instruments of environmental law.

Nic has lead teams and provided strategic direction for organisations, he has presented at national conferences on best practice for adaptive management and relationship management between local authorities and diverse natural resource projects.

Nic worked within a regional council where he has been a compliance programme manager and a water quality specialist responsible for reviewing applications for natural resource use, preparing meaningful and workable consent conditions and setting requirements for mitigation, control and monitoring with contractors in the Wellington region.

In the second phase of his career, working in consultancy both continuing with the policy and environmental effects assessments and directly undertaking project management for a wide range of clients including MfE, the EPA and several regional councils. Nic's recent experience leading expert teams has included Bay of Plenty (Plan Change 9 and 12), the Proposed

Nic Conland

Healthy Rivers Plan Change (PC1), Gisborne FWP, Auckland Unitary Plan, Selwyn Waihora Variation 1, Hekeo-HINDs Variation 2, Tukituki Plan Change 6, EPA Compliance Monitoring project, Environmental Manager for the Wellington Tunnels Alliance and AEE Project Manager for the Kawarau bridge replacement.

Nic has provided strategic water quality and policy advice for Wairakei Pastoral Limited, Ravensdown, Horticulture New Zealand and Landcorp Farming Limited on their water quality impacts for catchment management within a freshwater quality accounting framework under the National Policy Statement for Freshwater Management (NPS FM 2014) and regional plan developments in the Northland, Auckland, Waikato, Taranaki, Manawatu, Bay of Plenty, Wellington, Hawkes Bay, Canterbury, Otago and Southland.

Recent project experience

Project lead, Water Quality Evidence for Gisborne FWP, 2015-17

Client: Horticulture New Zealand

Role: Water Quality lead, Expert Evidence and Policy Advice

Project lead, Regional Plan Development – Kaituna and Rangitaiki Catchments, 2015 - Present

Client: Bay of Plenty Regional Council

Role: Project Lead, Freshwater Modelling and Policy Development

Project lead, Natural Resource Policy and Planning, 2015-Present

Client: Wairakei Pastoral Limited

Role: Natural Resource Advisor

Project lead, Water Quality Evidence for Auckland Unitary Plan hearing, 2015

Client: Horticulture New Zealand

Role: Project Lead, Expert Evidence and Policy Advice

Project lead, SOURCE Water Quality Modelling and Evidence for Selwyn Waihora Plan Change 1, 2014

Client: Primary Sector Partnership, led by Central Plains Water

Role: Project Lead, Expert Evidence and Policy Advice

Project Lead, SOURCE Water Quality Modelling and Evidence for Tukituki Plan Change 6, 2013

Client: Primary Sector Partnership, led by Horticulture New Zealand

Role: Project Lead, Expert Evidence and Policy Advice

EEZ Compliance and Monitoring Guidelines and Policy Advice, 2013-14

Client: Environmental Protection Agency

Role: Project Lead and Policy Advice

Transmission Gully, Water Quality and Erosion and Sediment Control, 2010-2013

Client: NZ Transport Agency

Role: Project Manager and Policy Reviewer

Resource Management Act Compliance and Enforcement, 2003-2010

Employer: Greater Wellington Regional Council

Role: Environmental Regulation Team Leader

- Direct management of three regulatory programme areas with 6 direct report staff and functional responsibility for 12 within the Environmental Regulation department.
- Direction and leadership of the regional council's responsibilities for compliance activities associated with the RMA. This role focused the council's available resources into areas of significant environmental risk.
- Compliance Programme development for the following activity areas: sediment discharges, wetlands, odour, agricultural wastes, landfill, and cleanfill.
- Coordination of the Fonterra Accord, dairy compliance for the Wellington Region.

Career History

2015 – Present: Environmental Science and Policy Advisor, Taiao NRM

2015 – 2019: Natural Resource Advisor, Wairakei Pastoral Limited

2010 – 2015: Jacobs Wellington Senior Environmental Consultant

2004 – 2010: Wellington Regional Council,

Nic Conland

Environmental Regulation team leader

2002 – 2004: Hutt City Council, Trade Waste Officer

2001 – 2002: Unilever Australasia, Process Analyst

1996 – 2001: Anchor Products Limited, Process Analyst Chemistry and Nutraceutical Formulation

1995 – 1996: Australian Laboratory Services, Analyst – Environmental and Geochemistry