Jim G. Cooke, D. Phil.

Water Quality/Water management Specialist

Education

D. Phil. – University of Oxford, UK, 1986

M. Phil. – Environmental Science, Massey University, Palmerston North, New Zealand, 1977

Dip Ag. Sc. (Div I) - Soil Science, Massey University, Palmerston North, New Zealand, 1974

B.Sc. – Earth Sciences/Biological Science, Waikato University, 1973

Experience Highlights

- 29 years experience at NIWA (and predecessor organisations) as research scientist, business development manager, Manager NIWA Australia, Leader National Centre Water Resources,
- 7 years consulting experience Beca Infrastructure, Diffuse Sources Ltd
- Founded Streamlined Environmental Ltd 2013
- Experienced (Good Decisions) Independent Commissioner (certification expires 31/12/2020) Chair's endorsement gained December 2015

Dr Cooke has worked on a wide range of environmental science issues, including nutrient inputs to lakes, nutrient runoff from pastoral agriculture, point source impacts from WWTPs and industry, nutrient cycling in wetlands receiving wastewater, environmental flow issues, diffuse source pollution from agriculture, forestry and urban stormwater, and assessments of the environmental effects of power schemes and water supplies. He has worked on projects in NZ, Australia, SE Asia, and the UK. Dr Cooke has applied his extensive environmental science experience in RMA Decision Making on significant consent applications in Canterbury, Wellington, Tasman and Waikato. He has recently gained Chairs endorsement through the Good Decisions Programme (through to December 2020).

Dr Cooke also combines his environmental science expertise knowledge and interest in the RMA and Regional Planning processes with commissions that advise clients on measures to achieve RMA objectives. This includes studies to support consent application, plan submissions, expert witness services, mediation where independent expert is important, s127 and s128 consent reviews, and ICMPs. Recent projects have included, determining the fate and transport of nitrogen from treated municipal wastewater applied to land and the implications to Whangateau Harbour (to support consent application to Auckland Council), and determining critical contaminant loads from an urbanizing catchment surrounding Lake Rotokauri and determining stormwater treatment requirements (ICMP development).

Specialty areas:

Municipal and Industrial Discharges

Catchment and Regional Water Management

Water Quality/Aquatic Ecology Management

Greenhouse Gas Management

Coastal water management

Water storage take and irrigation

Making Good Decisions (Independent Commissioner)

RMA Science Support

Selected examples of experience

Municipal and Industrial Discharges

Assessment of Ecological Effects for MBR WWTP treating sewage discharging to Lake Waikare. Lakeside Developments Ltd 2017 Dr Cooke was part of a SEL team assessing the effects of Membrane Bioreactor (MBR) treatment for a new development on the shores of Lake Waikare, near Te Kauwhata township. Te Kauwhata's (TeK) existing WWTP (ponds/aquamats/wetlands) is overloaded and unable to accept sewage from the new Lakeside Development, which will double the population of TeK. Lakeside's proposal is to treat both sewage from the new development, together with TeK's sewage to a high standard using MBR technology before discharge to Lake Waikare..

Fate and transport of nitrogen in treated wastewater applied to land from Omaha WWTP. Watercare Services Ltd 2015. Dr Cooke led this major study, used to support consent applications to Auckland Council. We conducted biochemical assays at irrigation sites (Omaha Golf Course and a eucalypt stand) situated on opposite sides of Whangateau Harbour. From these assays, chemical measurements at different depths of the soil profile, estimates of nitrogen uptake, and hydrogeological data (supplied by other consultants working on the project) we constructed a probabilistic model of nitrogen fate and transport. From this model we were able to show that most of the nitrogen applied in treated wastewater was lost by denitrification in unsaturated and saturated zones between the irrigation sites and the harbour and that effects on the harbour would be negligible, even with an increase in the volume of treated wastewater.

Review of mercury and heat treatment options for Wairakei power Station, Contact Energy Ltd. 2013 & 2016. Reviewed best practical options available internationally to reduce mercury and heat discharges to fulfill a consent condition for CEL with respect to its discharges to the Waikato River.

Catchment and Regional Water Management

Te Awa Lakes Water Quality Issues – Hamilton City Council 2017 Dr Cooke has been engaged by Hamilton City Council as an expert advisor on water quality aspects of a proposed Plan Change sought by Perry Group Ltd. The proposed land use change is from an existing sand quarry to an urban development on the northern outskirts of Hamilton, which would include a number of lakes (constructed in the old quarry workings) to provide both an aesthetically pleasing backdrop to the development, and an "adventure precinct". The development is predicated on the lakes being of "swimmable" quality.

Pollutant allocation modelling for the Waikato Catchment- Beef and Lamb New Zealand 2017 – Project Manager and team member for development of a pollutant allocation model and its subsequent use for analyzing impacts of different allocation scenarios under Waiora Plan Change 1 (Proposed Waikato Regional Plan Change). The results of the analysis will be presented at Plan Change 1 Hearings in 2018.

Water allocation modelling in the Upper Waikato (Dairy NZ - 2016) and Lower Waikato (Fonterra - 2017) Catchment Project Manager and team member for a

Simplified Water Allocation Model (SWAM) for the Upper and Lower Waikato Catchments being developed by Streamlined Environmental. Dairy SWAM will enable the Dairy Industry to understand how much water they are currently using (compared with what is nominally allocated based on herd size) and 'where they sit' compared with other users of water in the catchment.

ICMP for Rotokauri Urban Development Hamilton City Council 2014-15 Dr Cooke led a Streamlined Environmental team assessing the water quality impacts of the Rotokauri structure plan implementation to support an integrated catchment management plan for the scheme. The results of the study were presented at the 2017 Water New Zealand Stormwater Conference as is available here.

Water Quality/Aquatic Ecology Management

Lake Waikare Water Quality Modelling: Investigation into flushing with Waikato River Water, Waikato District Council. 2014. Project manager and team member of this study carried out to assist WDC to gain consent for continued discharge of Te Kauwhata's treated wastewater into Lake Waikare (submitter requested that a flushing study be done before withdrawing his opposition to the consent). We collected sediment samples from the bottom of Lake Waikare and samples from tributaries around the lake to supplement other data sources and to calibrate a SLAM (Simplified Lake Assessment Model). We obtained a satisfactory calibration and modelled the effects of various flushing flows on algal biomass within the lake. The results showed that flushing would potentially be effective at reducing peak algal biomass but that very large flushing flows would be required. In addition, flushing the lake could potentially move the problem to the Whangamarino wetland and Waikato River.

Development of a Decision Support System (DSS) for the application of Gemex^{TM} to Rivers infected with Didymo, MAFF Biosecurity NZ – 2008 Dr Cooke led this project to provide a decision support system to assist partner groups in deciding whether or not to use Gemex^{TM} (copper chelate) in the event of a didymo infection. The DSS guided the decision process and consent application process through consideration of river size & flows, toxicity to non-target species, water and sediment quality, and regulatory, cost, social and cultural issues.

Making Good Decisions (Independent Commissioner)

Independent Commissioner, Talley's Fish and Food Processing Consents, Motueka. Tasman District Council 2017 Water Quality expert on a 3- person panel hearing applications by Talley's Ltd for air and water discharge consents, occupation of coastal land (diffuser) and ancillary consents. The principal issue was the application of s107 of the RMA relating to discharge of conspicuous colour, oil and grease to the coastal environment. The consents were granted with conditions for a 3-year term. The applicant has appealed the decision to the Environment Court.

Independent Commissioner, Ostern Quarries Ltd for various consents in relations to various quarrying activities near Otorohanga. Waikato Regional Council and Otorohanga District Council 2017 Environmental Science expert on

3-person panel considering applications by Ostern Quarries Ltd for continued operation of their quarrying activities. The principal issues considered were noise (explosives and quarry traffic), dust, sediment discharge to stream, and access and pa sites. Consents were granted with conditions.

Independent Commissioner, AFFCO Horotiu Meat Works Reconsenting, Waikato Regional Council, 2016. Environmental Science Expert on 3-person panel considering applications by AFFCO NZ (Ltd) for continued operation of its Horotiu Meat Works. The application included water permits, landuse consents, and discharge permits (14 applications), the most contentious of which was the discharge permit for treated wastewater to the Waikato River. Environmental science issues that had an important bearing on the decision were: *river water quality*, particularly the relative sensitivity to nitrogen and/or phosphorus, aquatic ecology (effects on migratory fish, benthic ecology, algal ecology), *public health microbiology* (whether E coli have any relevance as a pathogen indicator and/or whether a full quantitative microbial risk assessment (QMRA) should be carried out), *air quality* (odour), *soil science* (fate and transport of contaminants through soils from pond leakage). Drafted environmental science parts of the decision.

Independent Commissioner, Motuapa Marina, Lake Taupo Consent Application. Waikato Regional Council 2015 Environmental Science expert on 3-person panel considering an application from Department of Internal Affairs to construct and operate a new marina at Motuapa, near Turangi. An existing marina, which has poor water quality operates under permitted activity status. The principal issues under dispute were: (i) whether the permitted activity status remained for the new marina, (ii) the effectiveness of a proposed recirculation system within the new marina and conditions required (or otherwise) to monitor its effectiveness, (iii) the impacts of a reclamation on a rare 'turf' species, *Isolepis fluitans,* and the effectiveness of biodiversity offsets proposed by the applicant. Environmental science expertise that was important in the decision-making process included *lake and embayment water quality*, *aquatic plant biodiversity*, and conservation *biodiversity offset* principles. Drafted environmental science parts of the decision.

Independent Commissioner, Mangatangi Coal Mine Consents. Waikato Regional Council and Waikato District Council 2013, Water management/Ecology expert on 3-person panel considering applications by Glencoal Ltd (Fonterra Subsidiary) to develop and operate an open cast coal mine near Mangatangi. The principal technical issues considered were *air quality* (coal dust and the potential for health issues amongst local residents), *hydrology and water allocation* (environmental flows and abstractive volumes required for dust control), and *water quality* of discharges (principally boron, and suspended sediment). Drafted water management parts of the decision.

Independent Commissioner. River Recharge with Groundwater. Greater Wellington Regional Council 2013. Environmental science expert on panel considering application for consents from Kapiti Coast District Council, to recharge the Waikanae River with groundwater pumped from the Waikanae deep aquifer to maintain minimum flow levels at times of heavy abstractive demand for the Kapiti Coast drinking water supply. Principal environmental science issues considered were; (i) *groundwater geohydrology* particularly

potential for saline intrusion from excessive pumping, (ii) *river water quality* the potential for groundwater pumping to add higher levels of contaminants to the river than occur without pumping,(iii) *aquatic ecology* algal proliferation in the lower Waikanae River (especially cyanobacteria), migratory fish avoidance; and (iv*) wetland ecology* effects of fluctuating water levels on plant ecology in significant wetlands. Drafted environmental science parts of the decision.

Independent Commissioner. Application for irrigation consents RH Robertson. Environment Canterbury 2013. Sole Commissioner hearing applications (take and use, dam, discharge) for a deer farm in the Hakataramea Valley. Principal issues considered were *environmental flows, aquatic ecology effects, bore water supply, dam safety*. Wrote and issued decision.

Independent Commissioner Otorohanga Wastewater Discharge consents. Waikato Regional Council 2012. Environmental science expert panel member for this application (renewal) to discharge treated wastewater to the Mangarongo Stream (tributary of the Waipa River). Principal issues considered were *water quality* particularly bacteria and *public heath issues*, and nutrient. Drafted water management and public health aspects of the decision.

Independent Commissioner - Upper Waitaki Resource Consents Hearing, Environment Canterbury 2009-2012. Environmental Science expert member of a panel considering the application for 61 consent applications to take and use (for consent applications in the Upper Waitaki Catchment and associated land use consents). The main issue was the cumulative effects of irrigation on the trophic status of Lake Benmore and the water quality and ecological effects (periphyton) on associated inflowing rivers and streams, and groundwater. Other significant effects considered include landscape (greening of Mackenzie Basin), farm management practices and on-farm monitoring, economic costs and benefits, terrestrial ecology, and Maaori cultural values. Environmental science issues that were significant in the drafting of decisions included: *water quality* – particularly potential for increased nutrient discharges from large scale irrigated dairy farms on low nutrient status water in the Ahuriri Arm of Lake Benmore, *hydrodynamic modelling* of same, *soil science* – fate and transport of nutrients on skeletal soils, groundwater flow and directions, *aquatic ecology* – potential effects on algae and fisheries. Drafted environmental science chapters of Part A (catchment wide issues) and many of the individual decisions.

RMA Science/Policy Support

Implication of Healthy Rivers 1 for Port Waikato, Waikato Regional Council (2016 current) Leading a think piece on the implications of objectives, policies, and rules likely to be in place from Healthy Rivers 1 (Waikato river) on the Coastal Marine Area (CMA) at Port Waikato, and what learnings can be applied to future Heathy River Plans in terms of management of the CMA.

Developing knowledge-based monitoring frameworks for estuaries, Waikato Regional Council (2016 current) Member of Streamlined Environmental team developing a flexible framework for identifying and prioritizing sites for data collection within the CMA, based on an understanding of key drivers in the catchment, which integrates a range of interrogation and decision support tools, and that accommodates variations in data quantity/quality.

Section 127 review of discharge conditions at Pukete WWTP, Hamilton city council/MWH 2016 Provided independent scientific assessment for HCC's application under s127 RMA for a review of consent conditions.

Case Manager – s128 Review Waikare/Whangamarino, Department of Conservation 2014-15 Assisted the Department in developing a case strategy to obtain better conditions to reduce the impact of sediment discharge from Lake Waikare to the Whangamarino River and (incidentally) to the Whangamarino wetland. Liaised with expert witnesses and reviewed evidence to ensure it was consistent with the strategy and the Barrister handling the case on behalf of the Department.

Review of limits proposed in the Greater Wellington Regional Plan review process, Department of Conservation 2014 Analysed the rules and policies from the Greater Wellington Regional Plan working document in relation to the water quality aspects. The assessment considered whether the proposed limits and objectives were sufficient to achieve protection of freshwater biodiversity values, in terms of rivers, lakes, wetlands and groundwaters.

Professional Organistions

- International Water Association (member since 2003). Board member specialist group on Diffuse Pollution 2006-2011). Co-chair and organizer 15th International Conference on Diffuse Pollution, Rotorua, NZ September 2011, Chair IWA NZ committee 2011-2013
- Member NZ Freshwater Sciences Society since 1993

Regional Council Freshwater Management Methodologies – accounting systems and limit setting, Ministry for the Environment 2013. Water quality expert team member of NIWA-led project assessing Regional Council readiness for limit setting as defined by the National Policy Statement for Freshwater Management, and the water quality and quantity accounting requirements of the 2013 and beyond water reforms.

Expert Witness Proposed Canterbury Land and Water Regional Plan, Fish and Game North Canterbury 2013. Presented water quality evidence to Commissioners deciding on the proposed plan, utilising modeling results from Dr Tim Cox on the potential effects of different irrigation scenarios on nitrogen concentrations and loads in the Ashburton, Selwyn-Waihora, and Rakaia Rivers.

Independent Chairman of Te Kauwhata Consultation Group, Waikato District Council, 2011 -2012 WDC applied to renew consents to discharge treated wastewater from Te Kauwhata into Lake Waikare, a hypertrophic lake beside Te Kauwhata. Dr Cooke chaired a series of meetings between the council and submitters, mediated between the parties and provided an independent scientific view on the principal issue which was the continuing deterioration of the lake.

Selected Publications

Cooke, J.G. , Cox, T., Stewart, M., Phillips, N and Hart, R. 2017. Determining stormwater treatment requirements for a greenfields development in the catchment of a hypertrophic lake . Paper presented at Water NZ Stormwater Conference, Auckland, May 2017, 20 pp.

Cox, T. and Cooke, J.G. 2015. Lake Waikare Water Quality Modeling: using a new model to investigate flushing strategies. Paper presented at Water NZ Annual Conference, Hamilton , September 2017, 19 pp.

Cooke, J.G 2014 Are rising nitrate levels in rural groundwater a public health concern? Water (Water NZ magazine) March p 63-65

Cooke, J.G.; Milne, P.; Rutherford, J.C. 2010. A Review of Definitions of Mixing Zones and Reasonable Mixing in Receiving Waters. Auckland Regional Council Technical Publication TR2010/045

Cooke, J.G. (1994) Nutrient transformations in a natural wetland receiving sewage effluent and the implications to waste treatment. Water Science and Technology. 29(4): 209-217.

Cooke, J.G.; Hickey, C.W. and Tanner, C.C. 1992 Critical Review of techniques for the reduction of ammonium in rural point source discharges. Auckland Regional Council - Environment and Planning Division Technical Publication No. 8.

Cooke, J.G. 1992 Phosphorus removal processes in a wetland after a decade of receiving a sewage effluent. Journal of Environmental Quality 21: 733-739.

Cooke, J.G.; Stub, L. and Mora, N. 1992 Fractionation of phosphorus in the sediment of a wetland receiving a sewage effluent. Journal of Environmental Quality 21:726-732.

Cooke, J.G.; Cooper, A.B. & Clunie, N.M. 1990 Changes in the water, soil, and vegetation of a wetland after a decade of sewage inputs. NZ Journal of Ecology14:37-47.

Cooke, J.G. 1990. Rapid freezing effects on nitrification and denitrification enzyme activity in saturated soil and aquatic sediments. Soil Biology and Biochemistry 22:1171-1172.

Cooke, J.G. & A. Dons 1988. Sources and sinks of nutrients in a New Zealand hill pasture catchment I. Stormflow generation. Hydrological Processes 2: 109-122.

Cooke, J.G. 1988. Sources and sinks of nutrients in a New Zealand hill pasture catchment II. Phosphorus. Hydrological Processes 2: 123-133.

Cooke, J.G. & A.B. Cooper 1988. Sources and sinks of nutrients in a New Zealand hill pasture catchment III. Nitrogen. Hydrological Processes 2: 135-149.

Cooke, J.G. & R.E. White 1988. Nitrate enhancement of nitrification depth in sediment/water microcosms. Environmental Geology and Water Science 11: 85-94.

Cooke, J.G. & R.E. White 1987. Spatial distribution of denitrifying activity in a stream draining an agricultural catchment. Freshwater Biology 18: 509-519.

Cooke, J.G. & R.E. White 1987. The effect of nitrate in stream water on the relationship between denitrification and nitrification in a stream - sediment microcosm. Freshwater Biology 18: 213-226.