LAKESIDE
TE KAUWHATA

27 June 2017

LAKESIDE PLAN CHANGE REQUEST FOR FURTHER INFORMATION RESPONSE – SECTION 1 WASTEWATER

The purpose of this paper is for Lakeside Developments 2017 Limited ("LDL") to provide a response to the "Lakeside Plan Change Request for Further Information" letter from Bloxam Burnett Olliver received on 25 May 2017 specifically is regards to Section 1: Wastewater.

1. Overview

The LDL Private Plan Change submission includes an overall wastewater treatment solution for the township of Te Kauwhata and the Lakeside development that would see the removal of the existing sewerage treatment ponds and the elimination of the wastewater discharge that is currently occurring into Lake Waikare (the "Wastewater Treatment Proposal"). LDL believe that the Wastewater Treatment Proposal will have an immediate positive impact on the water quality of Lake Waikare and the surrounding environment.

LDL has already commenced the preparation of the Discharge Consent application for the Wastewater Treatment Proposal. This includes the preparation of the application and the AEE which will be lodged with the Waikato Regional Council ("WRC"). The preparation of the Discharge Consent application will take a period of time to complete and lodge (likely to be two (2) to three (3) months).

In our view, it would be unreasonable for the Council to not proceed with the notification and assessment of the Private Plan Change application pending the lodgment of the Discharge Consent application with WRC. LDL would accept that the hearing of the Private Plan Change application would not take place until the Discharge Consent application has been lodged.

LDL would also like it noted that the Waikato District Council ("WDC") has submitted to MBIE an application for funding from the Housing Infrastructure Fund ("WDC Application"). The application for funding to MBIE is to (amongst other things) allow WDC to:

- construct a new wastewater trunk line and associated components to carry wastewater from Te Kauwhata to Huntly; and
- to upgrade the Huntly wastewater treatment plant.

The Wastewater Treatment Proposal and WDC Application clearly demonstrates that there are several options available to provide the necessary wastewater infrastructure to service the Lakeside development and further reinforces LDL statement above that it would be unreasonable for the Council to not proceed with the notification and assessment of the Private Plan Change application pending the lodgment of the Discharge Consent application with WRC.

LDL believes that the Wastewater Treatment Proposal, as outlined within Private Plan Change application, is a logical and cost-effective solution to the existing Te Kauwhata wastewater infrastructure issues. As has been previously stated, LDL would welcome the opportunity to work cooperatively with Council to progress this Wastewater Treatment Proposal in a timely fashion.

2. LDL Private Plan Change Wastewater Treatment Proposal

LDL's Wastewater Treatment Proposal is further described as:

- LDL is proposing to construct a Membrane Bioreactor ("MBR Treatment Plant") with the capacity to treat the wastewater that is currently treated by the existing Te Kauwhata Wastewater Treatment ponds ("TK WWTP"), the wastewater that would be generated by the Lakeside development, and the wastewater

that would be generated by the future growth within the Te Kauwhata structure plan. LDL has engaged Mena Water New Zealand Limited to complete the detailed design of the MBR Treatment Plant and the associated civil works required to bring the plant on line. MBR Treatment Plants are common around the world and are recognised as being effective at treating wastewater and there are an increasing number of these plants currently operational in New Zealand. The treated effluent produced is of a very high quality and is commonly discharged to ground, so as to replenish the treated water with minerals which are stripped out during the treatment process.

- LDL will submit a consent application with WRC in August 2017 for a 35 year discharge consent to dispose of the treated wastewater (once it has been processed by the MBR Treatment Plant) via engineered reed beds (a form of wetland / dispersal cell) sited within the Lakeside development between 300 metres and 600 metres from Lake Waikare and above flood flow levels (the "Discharge Consent"). The proposed disposal route is further described in section 6 of the Candor 3 report entitled "*Proposed Infrastructure and Servicing Report*" and also below in RFI Response Part ii. LDL has engaged Streamlined Environmental Limited to complete the required assessment of environmental effects for the proposed MBR Treatment Plant discharge ("AEE").
- Upon successful granting of the Discharge Consent, LDL will offer Council the option of either:
    - connecting to the MBR Treatment Plant, which would allow the wastewater which is currently treated by the TK WWTP and the wastewater which will be generated by the future growth within Te Kauwhata to be treated by the MBR Treatment Plant. In the event that Council elects to connect to the MBR Treatment Plant, then the MBR Treatment Plant will be constructed within the Council owned parcel of land which contains the existing TK WWTP (further described as title SA55D/100). This would enable the existing TK WWTP to be decommissioned and Council the opportunity to redevelop this parcel of land into a public reserve which will border Lake Waikare.
    - not connecting to the MBR Treatment Plant. In the event that Council elects this option, LDL would construct the MBR Treatment Plant (albeit a smaller plant) within the Lakeside development and will treat (and discharge) the wastewater which will be generated by the Lakeside development only.
- The timeframe for construction of the MBR Treatment Plant is six (6) months following receipt of the required Discharge Consent. Construction of the MBR Treatment Plant would occur as part of the initial development of residential lots within Lakeside.

As detailed above, LDL has already commenced the preparation of the Discharge Consent application. This includes the preparation of the application and the AEE which will be lodged with the WRC. The preparation of the Discharge Consent application will take a period of time to complete and lodge (likely to be two (2) to three (3) months).

3. Request for Further Information and LDL Responses

Part A: Please submit the information recommended by the Mott MacDonald report *'Te Kauwhata WWTP – Peer Review Report 28 March 2017'* within the executive summary and conclusion as part of an overall Consenting Strategy. This will require completion of each measure below:

LDL Response: LDL would like it noted that the Mott MacDonald report states that *"The overall concept of an MBR wastewater treatment plant as proposed, is appropriate for the proposed development"* and *"It is normal practice for the issues identified by this peer review to be answered as part of the resource consenting process and through the detailed design phase which will occur once the Private Plan Change application is approved."*

Part i: Confirm population, flows and loads, including obtaining actual influent flow and load data for the existing Te Kauwhata WWTP including peak wet weather flows).

LDL Response: LDL has requested and received the above information from Council and has provided the information to its consultants.

Part ii: Confirm effluent disposal route (i.e. land irrigation, wetlands, lake discharge) in consultation (obtaining agreement in principle from) key stakeholder groups;

LDL Response: As is detailed in section 6 of the Candor 3 report entitled "*Proposed Infrastructure and Servicing Report*"

> *The preferred method of disposal of treated wastewater (once it has been processed by the MBR Treatment Plant) is via engineered reed beds (a form of wetland / dispersal cell) sited between 300 and 600m from Lake Waikare and above flood flow levels.*
>
> *Reed beds are a common means of polishing wastewater post treatment and are in common use in Europe and other regions. The beds can be compartmentalised to allow rotation and resting of soakage media and, should soil media become less permeable over time, the soil media can be removed and replaced one compartment at a time. Careful selection of native salt marsh plants such as flax, sedges, toe toe and cabbage trees for the reed beds can help to remove any residual salts remaining after treatment. Control systems will be installed to ensure a consistent dosing rate throughout the day rather than the morning and evening peaks typically associated with wastewater flows.*
>
> *After soakage through the engineered reed beds, any excess flows will be passed through flat vegetated swales and onto the flat areas of the site where further soakage will occur. During high groundwater conditions or during heavy rainfall soakage may be limited however all treated wastewater will soak through the reed beds and will subsequently be highly mixed and diluted by stormwater runoff before it reaches any significant water body such as Lake Waikare*.

As you are aware, the Nga Muka Development Trust provided a letter of support to the Lakeside Private Plan Change which stated:

> *"The Trust Supports in principle the lodgment of the Private Plan Change by Lakeside Developments 2017 Limited to the Waikato District Council."* and
>
> *"The Trust endorses the following mitigation proposals:*
>
> - *reaffirms the position of removal of Wastewater from Lake Waikare,*
> - *the creation of a formal public access to Lake Waikare, and associated boardwalk,*
> - *the creation of the Iwi reserve and memorial site.*
>
> *The proposed mitigation options will not only address, but also improve a number of longstanding issues associated with the local environs."*

As per the RFI request, the Nga Muka Development Trust (as key stakeholder) has provided a letter of support to LDL proposed disposal route. A copy of this letter of support is annexed to this letter.

Part iii: Confirm sludge strategy (and dry solids requirement);

LDL Response: Following the detailed design of the MBR Treatment Plant, a sludge strategy will be determined which is the most appropriate. The adopted sludge strategy will be outlined within the Discharge Consent application.

Part iv: Develop preliminary design based on results of above investigations;

LDL Response: The preliminary design for the proposed MBR Treatment Plant is currently being completed and will form the basis for the Discharge Consent application.

Part v: Complete an assessment of environmental effects (AEE) and obtain regional council agreement for the preliminary design.

LDL Response: As detailed above, LDL has engaged Dr Jim Cooke and Dr Mike Stewart of Streamlined Environmental Limited to complete the required AEE. The AEE will be completed by the middle of August 2017. As is normal practice, LDL will engage with WRC ahead of the lodgment to ensure that the Discharge Consent application is complete and appropriate.

The biographies of Jim and Mike are attached to this letter.

Part vi: Prepare consent applications and lodge them with Waikato Regional Council so they can proceed at the same time as the LDL plan change process.

LDL Response: As per the comment above, work has commenced on the preparation of the Discharge Consent application for the proposed MBR Treatment Plant. It is envisaged that the consent application will be lodged with WRC by the end of August 2017.

Part B: Please provide confirmation that LDL 2017 Ltd will enter into a Private Developer Agreement to collaborate on the renewal of the Council's wastewater discharge consents, given the compounded complexity that will apply to this requirement, in light of the LDL proposal.

LDL Response: As per the previous discussion held with Council, LDL is very agreeable to entering into a private developer agreement with the Council. The constraint on timing for this in LDL's view has been the Council's ability to respond, rather than LDL's commitment to an agreement.

Part C: Please confirm proposed staging/timing of new LDL lots, and when LDL envisages provision of the first module of MBR treatment plants (and timelines/cut off points for adding additional modules).

LDL Response: As detailed above, the construction of the MBR Treatment Plant would commence following receipt of the Discharge Consent and would be constructed as part of the initial development of residential lots within Lakeside.

The proposal is to construct the MBR Treatment Plant in two (2) stages.

Stage 1 would have enough capacity to treat wastewater generated by approximately 2,000 dwellings / 5,000 people. This would consist of the wastewater being treated by the TK WWTP (approximately 756 dwellings / 1,890 people[1]), the wastewater generated by 50% of the Lakeside development (approximately 800 dwellings / 2,000 people), the forecast future growth in Te Kauwhata between 2023 & 2018 (approximately 184 dwellings / 461 people[2] and a contingency factor of approximately 260 dwellings / 650 people (13% of the total stage 1 capacity).

The timing of the second stage of the MBR Treatment Plant, will ultimately be determined by the demand for additional homes within Te Kauwahta.

Yours sincerely

Simon Ash
Lakeside Developments 2017 Limited

[1] Waikato District Council medium population forecast 2018.
[2] Waikato District Council medium population forecast growth from 2018 to 2013.

Annexure 1: Biographies of Dr Jim Cooke and Dr Mike Stewart

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

Dr Cooke has worked on a wide range of environmental science issues, including nutrient inputs to lakes, nutrient runoff from pastoral agriculture, nitrogen processing in streams and sediments, 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 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 technical expertise 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

Non-point contaminant sources – effects and management

Water storage take and irrigation

Making Good Decisions (Independent Commissioner)

RMA Science Support

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

Selected examples of recent experience

Fate and transport of nitrogen in treated wastewater applied to land from Omaha WWTP. Watercare Services Ltd 2015. Dr Cooke led this major study, which will be 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.

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 study focused on Lake Rotokauri (but also Lake Waiwhakareke and downstream waterbodies). and the potential for contaminants during and after construction of the urban area to cause a deterioration in water quality. Dr Cooke developed spreadsheet models of nitrogen and phosphorus leaving developing and mature areas. These were input into a SLAM (Simplified Lake Assessment Model) developed by Tim Cox to predict the resultant effects on phytoplankton levels within the lake. The validated model was then used to predict the level of on-site treatment of urban runoff required to result in no net decline in the quality of the lake. 70% removal of phosphorus was shown to be necessary to ensure no net decline. We also installed passive samplers in existing lake inlets and outlets and measured emerging contaminants and metals, which provided background data for proposed monitoring programmes during the urbanization process.

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). The results showed that flushing would potentially be effective at reducing peak algal biomass but that very large flushing flows would be required.

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, principally because this was the first major consent hearing since the Vision and Strategy for the Waikato River became operative.

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.

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.)

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.

Implication of Healthy Rivers 1 for Port Waikato, Waikato Regional Council (2016) 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.

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.

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.

Scientific methods to support a Proposed National Environmental Standard (NES) on Environmental Flows and Levels, Ministry for the Environment (MfE), 2006 – 2007. Dr Cooke was project manager for this project, which involved providing a road map for assessing environmental flows and levels in rivers, lakes, wetlands, and groundwaters to support the proposed NES Environmental for flows and water levels. The project also involved ensuring that there was a consensus view amongst experts drawn from NIWA, Geological & Nuclear Sciences, Cawthron Research Institute, Massey University, Aqualinc Research Ltd and Beca Ltd.

Definitions of 'reasonable mixing' and 'mixing zone', Auckland Regional Council, 2007 Dr Cooke led this project for Auckland Regional Council to derive a robust definition for inclusion in the Auckland Air, Land and Water Plan, taking both scientific and legal issues into account. Published as Auckland Council Technical Report 2010/045

Selected Publications (from 34)

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.; Rutherford, J.C.; Wilcock, R.J.; Matheson, F. 2008 Significance of wetlands in the agricultural landscape as sources of nitrous oxide emissions. Published on line at: http://maxa.maf.govt.nz/climatechange/slm/grants/research/2007-08/pdf/2008-33-significance-of-wetlands.pdf

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. 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. 1991 Conservation guidelines for assessing the potential impacts of wastewater discharges to wetlands. Department of Conservation Science and Research Series No 31 49 pp. Department of Conservation Wellington, N.Z.

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. & R.E. White 1988. The effect of prolonged exposure to acetylene on denitrification in a laboratory stream -sediment system. Water Research 22: 658-691.

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.

Williamson, R.B. & J.G. Cooke 1985. The effect of storms on nitrification rates in a small stream. Water Research 19: 435-440.

Michael Stewart, PhD

Environmental Chemist

Education

PhD in Chemistry – University of Canterbury, 1997

M.Sc. (Hons) – in Chemistry, University of Canterbury, 1994

B.Sc. – University of Canterbury, 1992

Experience Highlights

- Director, Streamlined Environmental Ltd, since December 2015
- More than 18 years professional experience as a chemist, having worked in the pharmaceutical /biotech (UK), academia (Australia), CRI and consulting (New Zealand) environments.
- 8 years, Environmental Chemistry Scientist (Level 3), NIWA, Hamilton, New Zealand.
- 3 years, Senior Research Officer (Level B), Institute for Molecular Bioscience, The University of Queensland, Brisbane, Australia.
- 2 years, Research Fellow (Level A), Marine Natural Products Research Group, The University of Melbourne, Melbourne, Australia.
- 3 years, Senior Natural Products Chemist, Institute of Grassland & Environmental Research, Aberystwyth, UK.

Dr Stewart has broad professional experience in many aspects of chemistry, having worked in pharmaceutical/biotech (UK), academia (Australia), and government and consulting (New Zealand) environments.

He has research and commercial experience in environmental chemistry, including the design and implementation of monitoring programmes on legacy and emerging organic contaminants, reviews of emerging contaminants in the aquatic receiving environment from SoE and RMA perspectives, monitoring programme reviews for council, water quality trend analysis, human health risk assessments of contaminants in mahinga kai species and assessments of ecological effects. His current research also encompasses chemical ecology, allowing development of previously acquired skills in mass spectrometry and natural products chemistry. Applications of this research have been in biosecurity and conservation.

Specialty areas:

Environmental Chemistry

Assessment of Ecological Effects

Chemical Ecology

Risk assessment

Natural Products Chemistry

Selected recent examples of experience

Environmental Chemistry/Water Quality

Assessment of effects of nutrients and emerging contaminants from WWTP discharges for reconsenting applications, *Watercare Services Ltd*, 2015-2016. Fieldwork, laboratory analyses and desktop

risk assessment on nutrient and emerging contaminant aspects of WWTP discharges. This is providing an assessment of environmental effects to advise Watercare in their application for reconsenting wastewater treatment plants (Omaha, Snells/Warkworth, Waiuku/Clarks) in the Auckland region.

An update on emerging organic contaminants of relevance for regional council marine sediment contaminant monitoring, ***Auckland Council, Environment Canterbury and Greater Wellington Regional Council,*** **2016.** Lead author on report for NZ's three largest regional councils on an update of international and national research and legislative aspects of emerging organic contaminants. Includes recommendations on which emerging organic contaminants to include in future state of the environment marine sediment monitoring programmes.

Development of passive sampling devices for analysis of bioavailable contaminants of current and emerging concern in the Waitemata Harbour, ***Streamlined Environmental, NIWA, Auckland Council*****, 2014-16.** Lead on research programme to develop passive sampling devices as alternatives to shellfish and water spot sampling environmental contaminant monitoring. Results suggest that passive sampling is a complementary technique to other water sampling methodologies, but more research and validation is necessary before it will be accepted in the regulatory framework.

Review of chemical tracers to differentiate WWTP sources from other faecal sources to the environment, ***Watercare Services Ltd*****, 2015.** Desktop review to provide Watercare with practical information on chemical markers and methods to distinguish various sources of faecal contamination to marine receiving environments.

Emerging contaminants, ***Regional Councils, NIWA Core Funding, Royal Society of New Zealand*****, 2009-2014.** Lead investigator on a NZ first field study of emerging contaminants within Auckland's marine receiving environment in 2008. This was supplemented by a RSNZ funded collaboration with a Spanish research group (2010) to expand the dataset to include pharmaceuticals. Second author on subsequent review for HBRC (2011).

Broad scale water quality assessment to inform the Rotokauri Integrated Catchment Monitoring Plan, ***Hamilton City Council*****, 2015.** Field and desktop analysis of heavy metals and current and emerging organic contaminants as baseline information for Rotokauri urban development. This involved the analysis of sediment and water contaminants. Passive samplers were installed in existing lake inlets and outlets to measure "averaged" water concentrations of emerging contaminants and metals. The results provided baseline data for proposed monitoring programmes during the urbanization process.

Review of polychlorinated biphenyls (PCBs) for Bream Bay Aquaculture Park, ***NIWA*****, 2014-15.** Assessment of PCB data from aquaculture fish species, fish feed and the surrounding environment to assist aquaculture scientist at Bream Bay in enhancing aquaculture productivity and survival.

Rotorua District Council stormwater consent, ***Rotorua District Council*****, 2014.** Project Manager assisting RDC in the preparation of a comprehensive stormwater consent for Rotorua city. Carried out a study to assess long-term water quality impacts arising from the cumulative effects of the quality and quantity of stormwater. The assessment strategy incorporated the characterisation of

stream, drain and lake sediments, stream biological surveys, and heavy metal concentrations in freshwater mussels in Lake Rotorua.

Shellfish Contaminant Monitoring Programme (SCMP), *Auckland Council*, 2013. Project Manager on a status and trends assessment and programme review of Auckland Council's SCMP. AC incorporated the recommendations from the review into their work programme, including collaboration with Dr Stewart on alternative monitoring technologies to replace the SCMP (see development of passive sampling devices example above).

Risk assessment

Risk assessment of potential human health and ecological effects of spills of on-site chemicals at Huntly Power Station, *Genesis Energy*, 2014. Developed risk assessment procedures to highlight potential human health concerns and ecological effects of unintended chemical spills from Huntly Power Station into the Waikato River.

Ecological risk assessment for applications of chlorine in the control of boat fouling by Mediterranean Fanworm, *Northland Regional Council*, 2014. Provided technical advice to NRC on correct methodology, risks and risk elimination for use of chlorine for control of invasive Mediterranean Fanworm on boats.

Mahinga kai human health risk assessment, *various funding/Iwi organisations*, 2009-2014. Initial role within HRC programme (2009-2011) involving design of field studies, overseeing field studies and contaminant analyses and development of human health risk assessment procedures for important mahinga kai species. Included studies in South Canterbury (Arowhenua), Rotorua Lakes (Te Arawa) and Whakatane (Ngati Hokopu). Provided chemical and risk assessment expertise for Lake Omāpere tuna assessment (2012). Lead investigator working with Te Waihora Management Board and ECan on mahing kai biohealth study in Lake Ellesmere (Te Waihora) (2014).

Chemical ecology

Novel method for quantifying lamprey migratory pheromone in NZ streams, *MBIE*, 2006-current. Development of methods based around Polar Organic Chemical Integrative Samplers (POCIS) and liquid chromatography-tandem mass spectrometry (LC/MS/MS) for detection of a lamprey-specific pheromone in New Zealand streams. The method was used to estimate resident lamprey larval populations in streams, which could be used as a baseline in restoration strategies to enhance this taonga species. To date, the methodology has been utilised by Auckland Council, Department of Conservation and Horizons Regional Council.

Pest species impact and control, *NIWA Core Funding*, *MBIE*, 2006-current. Investigation of perch pheromones and semio-chemicals by radioactivity tracing, microchemistry and LC/MS. Lab, flume and lake scale efficacy tests have been undertaken for the development of a putative semio-chemical that attracts perch. The method has applications in pest control and sports fishing.

Chemical control and enhancement of marine crab species, *MBIE*, 2008-current. It is hypothesized that pheromones involved in sexual reproduction may be useful for control of pest species or enhancement of valued species. In New Zealand, the introduced Asian Paddle Crab (*Charybdis*

japonicus) is a marine pest while the native paddle crap (*Ovalipes catharus*) has potential for aquaculture. This project involves the investigation of pheromones in the urine of female members of these species by iterative bioassay (behaviour) directed fractionation. Identification of putative pheromone candidates has been via high resolution mass spectrometry, in collaboration with Analytica Laboratories.

Tuna (eel) species separation trial, *Te Ohu Tiaki o Rangitaane Te Ika a Maui Trust*, 2013-current. This project aims to be able to separate tuna species (longfin release and shortfin for aquaculture) at the glass eel stage via their olfactory response. Eel liver and tank holding water has been analysed by mass spectrometry techniques to identify chemical differences between species that could be used to differentiate species at the early life stages.

Natural Products Chemistry

Investigations of toxicity in the Georges Bay catchment, Tasmania, *Slater & Gordon Ltd*, 2009-2010. Undertook bioactivity directed fractionation and chemical identification of potential causative sources of toxicity to identify the chemicals implicated in oyster mortality in the Georges Bay catchment.

Selected Recent Peer-Reviewed Publications

Park, K.C., Baker, C.F., Stewart, M., Suckling, D.M. (Submitted). Extracellular recordings from the brain of the New Zealand paddle crab, *Ovalipes catharus*, and evaluation of olfactory-active compounds. *PLoS ONE*.

Baker, C.F., Jellyman, D.J., Reeve, K., Crow, S., Stewart, M, Buchinger, T., Li, W. (Submitted). First observations of spawning nests in the pouched lamprey (*Geotria australis)*. Can. J. Fish. Aquat. Sci.

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Annexure 2: Nga Muka Development Trust Letter of Support

NGA MUKA DEVELOPMENT TRUST

3 July 2017

Simon Ash
Lakeside Development 2017 LTD.
Level 2, 33 Shortland St
Auckland 1010.

Tena koutou,

Nga Muka Development Trust (Nga Muka) as representative of the marae cluster including Maurea, Horahora, Waikare, Taniwha and Okarea marae provide this support of the Winton Partners Lakeside Development at Te Kauwhata.
The Winton Partners - Lakeside Developments team including consultants have to date carried out the following consultation meetings with Nga Muka and other Iwi stakeholders.

- Initial meeting with Tim Manukau Waikato Raupatu Lands Trust
- Meeting with Glen Tupuhi Nga Muka Development Trust 10 November 2016.
- Attended Nga Muka meeting at Hora hora Marae 1 December 2016.
- Attended Nga Muka meeting at Waikare Marae 8 March 2017.
- Representatives of 5 marae, Lakeside Developments and Waikato District Council visited the Rotorua Wastewater Treatment Plant.
- Attended Nga Muka meeting at Okarea Marae 9 May 2017
- In addition to these Iwi specific consultation meetings they have presented the development proposal to the Te Kauwhata community.
- Interspersed by meetings and correspondence between members of both parties.

The quality of engagement and transparent consultation has resulted in the positive efficacy of the relationship between Nga Muka Development Trust and Lakeside Developments.
Find attached a letter Tony Whittaker, General Manager Strategy and Support Waikato District Council dated 3 July 2017 that covers ongoing discussions with Lakeside Developers in greater detail.

Nga Muka Development Trust supports the residential development of Lakeside Developments 2017 Ltd.

Kia hora te marino;

Glen Tupuhi
Chair Nga Muka Development Trust
0212844440

cc:
Tony Whittaker, General Manager Strategy and Support Waikato District Council.
Tim Manukau, Waikato Tainui.

NGA MUKA DEVELOPMENT TRUST

3 July 2017

Tony Whittaker
General Manager Strategy and Support
Waikato District Council
Private Bag 544
Ngaruawahia 3742

RE: Lakeside Development Te Kauwhata.

Tena Koe Tony,

Waikato Tainui have a network of marae clusters across its traditional and shared rohe. Nga Muka Development Trust is a cluster of 5 marae from Rangiriri to Waiterimu valley namely Maurea, Horahora, Waikare, Okarea, Taniwha marae.
Environmental protection and restoration is one of the core functions of the Nga Muka Development Trust, the Waikato Tainui Environment Plan Tai Timu Tai Pari Tai Ao provides the overarching policy direction for all land and water based activities. The other core functions are cultural, economic and social development.

Lakeside Development, Te Kauwhata
Since initiating contact with Nga Muka Development Trust the Winton Partners - Lakeside Developments team including consultants have to date carried out the following consultation meetings with Nga Muka and other Iwi stakeholders.

- Initial meeting with Tim Manukau Waikato Raupatu Lands Trust November 2016.
- Meeting with Glen Tupuhi, chair Nga Muka Development Trust 10 November 2016.
- Attended Nga Muka meeting at Hora hora Marae 1 December 2016.
- Attended Nga Muka meeting at Waikare Marae 8 March 2017.
- Representatives of 5 marae plus 2 Huntly marae, Lakeside Developments and Waikato District Council staff visited the Rotorua Wastewater Treatment Plant, 27 March 2016.
- Attended Nga Muka meeting at Okarea Marae 9 May 2017.
- In addition to these Iwi specific consultation meetings they have presented the development proposal to the Te Kauwhata community.
- Interspersed by meetings and correspondence between parties.

The quality of engagement and transparent consultation has resulted in the positive efficacy of the relationship between Nga Muka Development Trust and Lakeside Developments.

Faced with the inevitability of development in the area Nga Muka Development Trust entered into the RMA resource consent consultations with Lakeside Developments determined to establish a relationship that produced outcomes of mutual benefit to both parties as well as the wider community. Of particular interest to Nga Muka was the offer by Lakeside Developments to construct a wastewater treatment facility that could replace and substitute the current wastewater treatment facility and capability.

NGA MUKA DEVELOPMENT TRUST

The concerns of the Nga Muka Development Trust is summarised as follows;

- Lake Waikare is a taonga that has been subjected to successive environmental and developmental insults, resulting in a very degraded water body.
- Local Iwi have historically been left out of the decision making processes that have culminated in the current degraded state of the lake and surrounding environs.
- Local Iwi have consistently voiced opposition to the discharge of treated wastewater into Lake Waikare.
- Significant numbers of local Iwi did not provide informed consent to the decision to pump wastewater from Springhill Prison to Te Kauwhata wastewater treatment plant and ultimately to Lake Waikare, that opposition prevails.
- Nga Muka Development Trust and members of local Iwi have concerns about the current and forecasted population and development growth of Te Kauwhata and surrounding area.
- Since the construction of the Springhill Prison there has been a rise in the population of inmates, staff, contractors, tutorial, therapeutic, cultural and family visitors on a daily basis to that facility. Consequently impacting on the volume of generated wastewater that is being treated at the Te Kauwhata plant and ultimately discharged into Lake Waikare.
- The tourism/education initiatives that are inevitable in the Rangiriri settlement post the completion of the expressway re-alignment and re-construction of the battle site will progressively result in more daily visitors.
- Te Kauwhata is a bi-cultural township unlike the distinct separation of cultures that occurs across Auckland or in Huntly and Ngaruawahia where the river serves as an unintentional cultural divider. Our concern is that the degree of residential development occurring in the Te Kauwhata township has the inevitable impact of escalating the cost of housing thus causing over time, a "brown" exodus from that community. There is ample research in regards to employment, economic and housing inequalities for Maori including the plummeting Maori home ownership rates.
- Rates increases are inevitable in order to provide or increase amenities including the wastewater treatment facility in order to cater to a growing population. Investor landlords will pass such increases on to their tenants.
- Nga Muka Development Trust is a member of the Te Kauwhata Wastewater Consultation Group which to date has proven to be devoid of a viable alternative to the wastewater discharge concerns and consequently heading toward yet another renewal of the existing consent.
- The recently revived proposal to pump wastewater to a yet to be constructed wastewater treatment facility based in Huntly has obvious engineering and cost implications. That proposal will have to navigate more concerted and organised Iwi opposition and safeguards in regards to the ultimate discharge to land or water especially in light of the progression of the Healthy Rivers implementation. The time factor of completing a project of that scale and continuation of the current discharge to Lake Waikare in the face of projected growth is a concern to Nga Muka Development Trust.

It is against that backdrop that the proposal by Lakeside Development to construct a wastewater treatment plant under a Private Public Partnership (PPP) the terms of which are yet to be decided, with Waikato District Council and hopefully central government via the MBIE Housing Infrastructure Fund amongst other enabling mechanisms has been positively considered by the Nga Muka Development Trust.

NGA MUKA DEVELOPMENT TRUST

Nga Muka Development Trust position;

In March members of Nga Muka Development Trust including representatives from 2 Huntly based marae visited the Rotorua Lakes Council Wastewater Treatment plant organised by Lakeside Developments, we were also accompanied by Waikato District Council staff.
We received a tour of the plant by the Water Operations Environmental Scientist Alison Lowe who shared information about the 5-stage Bardenpho wastewater treatment process that preceded discharge via ground to Lake Rotorua.
We also take into account other key factors such as the level of national protection over the highly sensitive inter-connected Rotorua lakes as well as the support that Rotorua Iwi have provided to the installation of that particular wastewater treatment model.
Furthermore Nga Muka Development Trust is an initiator and partner in a research site based at the Matahuru stream inlet into Lake Waikare. The purpose of the research is to measure what and how effective native plants especially manuka and kanuka, are in reducing nitrogen and other pathogens that are harmful to the water quality of the lake such as e-coli, campylobacter etc. Other partners in this research include the Centre for Integrated Biowaste Research (CIBR), Institute of Environmental Science and Research Limited (ESR), Lincoln University, Waikato Regional Council (including land water science capacity) and a connection via Ecoquest Education Foundation to the University of New Hampshire USA. Waikato District councilor Jan Sedgwick is on the governance body of this research project. Access to this scientific partnership capability has provided Nga Muka Development Trust with considerable technical advice about water quality issues and in particular wastewater treatment and discharge.

Consequently Nga Muka Development Trust has changed its policy of zero tolerance to wastewater discharge into Lake Waikare based on the following absolutes.
The construction of a treatment facility that has the capability to treat consistently wastewater to the level of quality determined via legal consent, by the Rotorua Lakes Council wastewater treatment plant.
That the treated wastewater is then filtered by constructed wetland to Lake Waikare.
Via this proposal the wastewater will traverse the lake and Whangamarino wetlands and ultimate enter the Waikato River north of Meremere, therefore downstream of the current Watercare outlet for greater Auckland consumers.

Taking all that into account as well as other matters Nga Muka Development Trust supports the Lakeside Development 2017 Ltd development proposal.

Kia hora te marino;

Glen Tupuhi
Chair Nga Muka Development Trust
0212844440

- Attached letter of support to Lakeside Developments 2017 Ltd.
- Letter to Mr Ashley Angus Procurement Officer MBIE.

Cc: Simon Ash, Lakeside Developments 2017 Ltd.
Jan Sedgwick, WDC Whangamarino Ward Councillor
Tim Manukau Waikato Tainui.

Mr Ashley Angus
Procurement Officer
MBIE NZ Government and Property
P.O Box 1473
Wellington 6140.

10 April 2017

RE: Application for funding from the Housing Infrastructure Fund – Call for final proposals.

Tena koe Ashley

Nga Muka Development Trust (Nga Muka) is a cluster of marae under the umbrella of the Waikato Tainui tribal infrastructure. Marae of the Nga Muka cluster are in the Rangiriri, Te Kauwhata, Waerenga area.

This letter is to support in principle, the application to the "Housing Infrastructure Fund Call for Final Proposals" for and on behalf of the Winton Partners Lakeside development in Te Kauwhata.

Nga Muka Development Trust and Waikato Tainui as submitters to the current wastewater consent have consistently opposed the discharge of wastewater from the Te Kauwhata wastewater treatment Plant into Lake Waikare. This issue forms the primary basis of our support in principle of Winton Partners Lakeside Development that includes the development of wastewater treatment that will bring a cessation to the current wastewater discharge into Lake Waikare.

The historical importance of the wetlands, waterways including the aquatic and bird life of the Lower Waikato ecosystem to mana whenua is well documented. Lake Waikare is one of a group of seriously degraded inland water bodies in the country and whilst there are multiple factors that contribute to its current degraded state the cessation of wastewater discharge will remove another significant insult to the water quality and health of the lake. Lake Waikare is connected to the Whangamarino wetlands a Ramsar site on a list of wetlands of international importance. Ultimately the waters make their way back to the Waikato River all of which are subject to the implications of the Healthy Rivers plan change provisions.

The Te Kauwhata wastewater treatment is by modern best practice standards not appropriate to cope with current volume or projected growth. Apart from the volume of wastewater of the immediate Te Kauwhata township the plant has to cope with the following;

- Wastewater from the Rangiriri settlement. Now that the adjacent section of the Waikato expressway has been completed along with the restoration of the historic battle site of the invasion of Waikato tourism and related businesses are mushrooming. Those initiatives will inevitably attract more visitors to the settlement which will increase the volume of wastewater.
- Wastewater from Springhill Prison. Since the construction of the prison facility there has been increased inmate population resulting in increased staff, daily visitors ie tutorial, cultural, psychological-therapeutic and family-whanau etc. Which results in more wastewater volume than was originally stated or anticipated.
- The current and future growth of Te Kauwhata and immediately surrounding district. This development alone will double the size of the Te Kauwhata township.

Te Kauwhata is experiencing rapid growth and property investment has escalated property prices consequently placing pressure on rental increases and home ownership opportunities by Iwi members residing in the area. Therefore rates rise minimization is a factor in our efforts to date to find solutions with central and local government entities which is an aspect of the Winton Partners proposed wastewater development and investment into the community.

The removal of the discharge from Lake Waikare in as short a timeframe as possible is the collective aims of both applicants and opposing submitters in the current consent. The search for a solution that would result in the cessation of discharge into Lake Waikare has largely stagnated because of the complexities involved and the cost impact.

Options to the current situation circulating amongst Council and the Te Kauwhata Wastewater management group have included;

1. Discharge via created wetland seepage to Whangamarino or directly to the Waikato River both of which would encounter significant opposition and or protections.
2. Piping the wastewater to Maramarua Forestry and land dispersal similar to the Rotorua wastewater management programme. Apart from cost and the different terrain to the porous pumice sediment in Rotorua the treaty settlement process over the forestry and desire for alternative land use post settlement pose significant obstacles to this option.
3. Council plans to build a super wastewater treatment plant at Huntly. Cost, ratepayer mass and time are factors however there appears to be no reason why the wastewater development as proposed by Winton Partners could not ultimately be linked up to the proposed super plant for further treatment in the future one would think that a localized catchment and/or partial treatment would be built into that overall proposal anyway.

Thank you for consideration of these matters Kia hora te marino.

Glen Tupuhi

Chair, Nga Muka Development Trust

16 Riverview Terrace Hamilton 3214.

Cc

Tony Whittaker, General Manager Strategy and Support. Waikato District Council Private Bag 544 Ngaruawahia 3742.

Simon Ash, Winton Partners Level 2, 33 Shortland St Auckland 1010