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File Note From: Andy Bruere
Lakes Operations Manager

File Reference: **Date:** 27 April 2012

Subject: **Technical Advisory Group meeting notes - 20 April 2012 held in the Rotorua Office**

Those in attendance were:

Paul White, Rob Donald, Paul Scholes, Piet Verburg, Diane Harvey, Marie Dennis, Deniz Özkundakci, Chris Palliser, David Hamilton, Alison Lowe, Andy Bruere, Mark Buckley, John McIntosh, Janine Barber, Clive Howard-Williams, Max Gibbs and Janine Barber.

1 Apologies

Kit Rutherford, Hera Smith, Warwick Silvester, Peter Dine.

2 Matters arising from last meeting

2(a) Lake Tikitapu monitoring

Max Gibbs gave an update on the current monitoring in Lake Tikitapu. This was undertaken as a result of concerns raised by Chris Hendy (University of Waikato) about movement of sediment in areas of the bottom of Lake Tikitapu. PowerPoint presentation is attached. i)

Two ADCP and turbidity sensors were placed in the lake. Monitoring was undertaken during the marathon water ski race events on 17 March and prior to this event. Max concluded that the impact of the boating went down about 2.5 metres and at a 5 metre depth there was no effect. The main conclusion from this work is that some other influence must be shifting sediment in the bottom of the lake. Max suggested that it is possible sediment could be disturbed by entrainment into a flow from a warm water vent in the bottom of the lake. However, there is no evidence of any such vents being located in the Lake previously. Some other suggestions included following up on that matter with a thermistor chain located in the disturbed area to see if there is any thermal activity. Also for monitoring to include silica analysis to see if there is any increase in silica concentration within the Lake as a result of unearthing of sediment.

Action:

- **Thermistor chain to be installed in the Lake Tikitapu for period of time to identify if any thermal activity but only after checking Eloise Ryan's PhD thesis which had a thermistor chain deployed in the lake in 2003**
- **Paul Scholes to request silica analysis be added to the monthly Bay of Plenty Regional Council monitoring work.**

- **David suggested it could be possible to do some sediment acoustic profiling for the Lake. He will investigate this proposal with Max Gibbs and report back to the group.**

2(a)(ii) Paul Scholes reported on stormwater monitoring and treatment works. He stated that road runoff figures for the Action Plan are at 1 and 7 percent nitrogen/phosphorus load, respectively. Monitoring was relatively difficult for the result which may be achieved and the main thrust here was to look at the possibility of installing structures particularly around road runoff to prevent sediment and road runoff reaching the lake directly.

Action:

- **Andy to convey the TAG's concerns regarding road runoff reaching Lake Tikitapu. This could include a submission to the Rotorua Ten Year Plan.**

It was also raised that logging was going to start taking place later this year around Lake Tikitapu and it could be worthwhile undertaking some sampling at that time to see the impact of forestry. This information could assist in providing some quantification of the impact of logging on adjacent Lake Rotokakahi, which was undertaken several years ago.

Action:

- **David to get Joe Butterworth to undertake some spot sampling of runoff points around Tikitapu during wet days.**

2(b) Janine Barber presented a PowerPoint presentation attached on groundwater progress around the greater Tarawera Catchment. ii) Three more bores had been put in during January around Tikitapu, Okaraka and Rotokakahi, however another bore between the forest irrigation scheme and Rotokakahi had not yet been put in. The focus was going to be putting further bores in at Rerewhakaaitu.

She outlined a number of things including that isotope data had been collected to enable aging of water. She also stated that the drilling information would assist in forming a geological model for the catchment which would in turn contribute to the groundwater model.

Paul White explained some of the groundwater work including attempting to target key geological formations. Finding out the time for water to get from the ground surface to each of the individual lakes. He discussed the possible seepage out below Tarawera outlet (possibly 2 cubic metres per second). He stated that they are now aiming to get better information on a Rerewhakaaitu catchment boundary.

There was some discussion around placing some monitoring bores on the western side of Ōkataina to get the Ōkataina/Rotorua boundary or heading further east to get more information around Rotoiti/Rotoehu southern catchment boundary.

Recommendation:

It was agreed by the group that the highest priority within these two choices was the Ōkataina/Rotorua boundary because that would impact possible focus on land use change if the boundary was found to be closer to Lake Rotorua and include more production farmland.

2(c) Max gave a brief update on the Rotoehu and the Lake Hayes work. In Lake Rotoehu there are 15 mesocosms doing three treatments plus control of alum + Aqual-P, Aqual-P alone and allophane. So far the conclusions are that phosphorus concentrations decline with all treatments and there are reduced algae. Some periphyton growth within the tubes caused

some complications in analysis results. With the rise in lake level of 1.5 metres the bag split. Max suggested that they needed to continue the trial next year with black plastic to exclude light for periphyton growth and will need to apply for a new consent to authorise the trial.

For the Lake Hayes experiment, algae bloom was not present in the previous season due to zooplankton predation.

Action: Andy and Max to discuss new consent process for trial continuation.

2(d) Wetland ecological work followed up by Andy.

The last TAG notes suggested further ecological evaluation of floating wetlands. So far no further progress has been made. David mentioned Rebecca Eivers' floating wetland trial in a drain in leading to a Waikato lake. Clive also mentioned the performance of the Ōkaro wetland. It was raised that earlier monitoring had shown about 50 percent reduction in nitrogen and phosphorus through the Ōkaro wetland however, a more recent report by NIWA had showed lower nutrient reduction.

Action:

- **Clive to follow up on results of Ōkaro wetland and report back on the reason for differences.**

It was also suggested by the group, a number of things could be considered in further wetland studies including bacteria monitoring as well as sediment changes beneath floating wetlands. **(For future actions).**

3 Sediment TAG update

3(a) Rotoehu progress

The discussion was to update the group on the de-stratification progress for Rotoehu.

(i) Project progress

Andy updated the group on progress including the Rotoehu buoy had been in since 2011 giving continuous monitoring results. David presented a summary of stratification and O2 decline in the Lake. He showed that blue/green algae spiked as stratification events occurred. He also presented modelling results of changes with respect to cyanobacteria. Once the de-stratification equipment is in the Lake, the results will be used by Hiroshi Yajima and the Waikato modellers to update the model code on aerated dispersion.

(ii) Ecological monitoring

Dennis presented a map showing the monitoring; attached. iii) He described the sampling programme and control sites. An additional buoy will be put in the Lake for a short period of time. This is the profiler buoy which had the monitoring equipment on the end of a chain which can move up and down in the water column. He also mentioned a sediment sampling programme which had seven sites to determine changes in sediment composition.

Paul Scholes was asking what the decision process was for turning the machine on and off. At this stage that has not been decided, however it's likely to be related to DO concentration in the bottom water. This will be determined from early model runs and experience.

4 Koura monitoring

Andy mentioned the Koura monitoring which has been undertaken by Ian Kusabs to determine any positive or negative effects from the de-stratification. Two tau have been put in the lake, one on the eastern side and one on the western side to determine changes in stratification on either side of the lake. These have been monitored at least twice so far and will be monitored through the programme.

4(b) Lake Ōkaro

Andy described the Aqual-P application on 19 December 2011. Seven tonnes of Aqual-P was applied to the lake by helicopter. A comprehensive monitoring programme was put in place prior to the application to determine whether the Aqual-P was successful in reducing algal concentration. Blue/green algae numbers persisted until about two to three weeks after the application.

David outlined the additional monitoring which was undertaken. This included ten additional days of monitoring and the samples are now being analysed for a range of parameters.

David also mentioned two theses which were useful in looking at blue/green algae, bacteria and virus numbers in Lake Ōkaro; by Bernard Simmonds and Marie Dennis, completed last year.

John McIntosh suggested that phosphorus levels in Lake Ōkaro are still too high and since we have resource consent could we apply five tonnes of kibbled alum to the Lake prior to winter mixing. John mentioned that five tonnes of kibbled alum was equivalent to 10 tonnes of liquid alum as applied in the 2003 application.

David mentioned that for Lake Ōkaro, the internal and external sources of phosphorus are about equal at the moment (50/50).

Action:

- **The group agreed that the proposal should be sent to the sediment TAG to work out application and timing. The advice John provided was application would need to occur by mid-May to be successful.**

Clive Howard-Williams made the following points:

- Concern regarding sediment recovering the capping layer.
- If phosphorus is coming back then it's not complete cover of sediment or there is additional phosphorus coming from external inputs.
- Within the catchment what was happening with phosphorus control?

It was discussed that the Aqual-P does not give a full cover, it's a very light layer and so some phosphorus can escape through it. Within the catchment works are continuing to reduce peak storm flows with sediment detention bunds and dams and phosphorus reduction is the target.

> Note: comment added to notes after meeting by John McIntosh: I think the fact is that not enough flocculent has been applied, if half the P load is still internal. An annual top up is possibly inevitable so perhaps we should consider a slow dose over an extended period. If we were aware of the currents in the hypolimnion it might be possible to slowly bleed in 10 tonne of alum between onset of stratification and mixing, say over 6 months – about 2 litres/hour, which would mix throughout the hypolimnion That could be done by gravity from a tank on Tony Lynsky's place.

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Action:

- **Paul and John Paterson to report back on monitoring of loads reaching the Lake. Max to check thermocline level for STAG meeting.**

4(c) Okawa Bay/Rotoiti resource consent application

Andy mentioned that the resource consent for Aqual-P and alum dosing in Okawa Bay was just about complete, giving us a continued ability to dose Aqual-P and alum into Okawa Bay if there are any algal blooms in that location.

David's hydrodynamic modelling around the Ohau diversion wall indicated that some operational settings of the Okere control gates had the potential to force water from Rotorua around into Okawa Bay raising nutrient levels.

4(d) Rotorua inflow models

Deniz presented on this work which has been undertaken by Wei Lee and Jonathon Abell. Deniz described the use of the SWAT programme on the Puarenga Catchment. He stated that currently some processes are not simulated and Alison commented that they could assist with some nutrient information around forest harvesting. The information provided useful information regarding base-flow and storm-flow discharges. There was some discussion around the input data and it was established that the flow monitoring site on the Puarenga had been shifted through the monitoring period. This needs to be resolved to allow correct interpretation of the results.

Action:

- **Deniz to get the history on the flow monitoring site from Glenn Ellery of Bay of Plenty Regional Council so that corrections can be made to the data.**

Paul White also raised that groundwater flows out of the Waipa catchment from an area of 'the Wash' to the south of Tarawera Rd and flows to the Lynmore catchment..

4(e) Lake Rotorua alum dosing

John gave a presentation on Lake Rotorua alum dosing. There are now two plants on streams going to Lake Rotorua (Utuhina and Puarenga). The aim was to dose about one part per million aluminium into the streams but a higher dose was applied to the Puarenga to see if the necessity for a third plant could be avoided. He described recent phosphorus reductions and also potential effects on nitrogen. The phosphorus concentration in Lake Rotorua has been reduced below the target of 20 mg/m^3. The in-lake nitrogen concentration has also followed a downward trend throughout 2011 although there was a build-up of nitrate in the lake from January 2011 to June 2011.

John mentioned that the aluminium dose was equivalent to what Max had calculated would be required to cap sediments in Lake Rotorua. Initially predictions had expected the aluminium to phosphorus uptake rate would be about 15/20:1 but in the lake, appeared to be getting about 5:1. This is probably because a longer time period is available for contact between the alum floc and phosphorus so that the reaction is more effective. Over the last year about 110 T of aluminium was dosed into Lake Rotorua through the two streams which had potentially locked up more than 20 tonnes of phosphorus.

With respect to the improvement in water quality in Lake Rotorua, Alison was questioning what effect additional rain in the last season had on Lake residence time. David said with a rainfall of two metres the residence time is still about one and a half years. The main effect was probably less stratification therefore less nutrient release from sediments. With the Lake model now, University of Waikato are going to include the effect of alum dosing so we will have some information on this in the near future.

John made the comment that there was an ammonia release in February 2012 but no dissolved phosphorus was recorded. Once the total phosphorus analysis was available it

would be possible to determine if phosphorus release had been suppressed. If this was the case it would be the first piece of evidence that sediment capping had occurred

4(f) Andy described to the group the incident of accidental alum discharge on the Utuhina Stream in late March. This error came about by a tank being filled by the supplier unbeknown to Council staff. It subsequently leaked into the bund which was full of water at the time and was pumped out to the Stream. It is estimated about two days of alum was discharged into the Stream over a period of five hours. Aluminium concentration would have been about 10 to 11 parts per million. The incident did not result in any fish kill but has resulted in significant changes to procedures to prevent this from happening again.

5 Update on Action Plans

Paul Scholes updated the group on the latest Action Plans being undertaken for Ōkataina, Tarawera and Lake Rotokakahi. John has undertaken nutrient budgets for these lakes and these have been reviewed by David.

Action:

- **Paul to send out nutrient budget drafts to the TAG.**

It was also discussed that the Tarawera budget will need upgrading regarding the 2 to 3 metres per second seepage that is occurring from the lake around the falls.

Paul mentioned the next Action Plan to be started will be the Rerewhakaaitu one.

David presented information around possible sources of nutrient impact on Lake Ōkataina. With Ōkataina being surrounded by bush and having very small areas of productive land catchment it is surprising to see the water quality declining. David showed slides of significant impacts on the understory of the bush by Dama wallabies based on exclosure plots in existence for some time. The comment was made that when retiring bush we cannot assume that nutrient releases will be the same regardless of areas. Ōkataina is a good example where damage to the bush may be causing significant nutrient impacts.

It was mentioned that this is possibly a good research project around nutrient inputs from damaged forest.

6 Rotorua sewage

Alison gave an update on the Rotorua sewage situation. She mentioned the annual nutrient load from the sewage to Lake Rotorua via Waipa Stream is about 40 tonnes of nitrogen and about 2 tonnes of phosphorus currently. All bio-solids from the district are now taken out of the district aiming to reduce the nutrient inflow from the landfill site.

She stated that the MBR plant is now being commissioned. This will take about a third of the inflow from Rotorua sewage and will run in parallel to the current bardenpho process. The MBR process is an activated sludge system followed by microfiltration.

She also stated that the forest irrigation area was still removing about 30 tonnes of phosphorus annually.

7 Update on Lake Rotomā sewage project

Mark Buckley updated the group on the Rotomā sewage:

- The resource consent application is now at the Environment Court and they are undertaking mediation with three parties:
    - Ngāti Pikiao, Ngāi Mākino and Rotomā Ratepayers.

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- The main objective from Rotomā Ratepayers is to prevent any nutrient flow back into Lake Rotomā and so monitoring has been suggested which will determine if there is any flow back into the lake and then the district council will need to look at options to deal with any back flow.
- Ngāti Pikiao was more interested in a decentralised system around Lake Rotoiti which would not include reticulation to the Rotomā system.
- The disposal system is an MBR, same as the new plant in town and then land disposal.
- Groundwater depth is between 14 and 35 metres plus. A court hearing date has been set for 9 July 2012.

8 Tarawera sewage

Mark Buckley update:

- In early January community presentation on this sewage proposal.
- Costs between $12.5–22M depending on whether it is a pressure pipe or gravity pipe system. Per-property cost of around about $24,000 to $44,000.
- John McIntosh mentioned that nutrient inputs for sewage had been recalculated on more accurate occupancy rates **(**1512 people including residents and visitors per annum resulting in an annual load of 5.5 tN/yr and 0.5 tP/yr). This makes up about half of the target reduction load. Over the last two years there has been a step reduction in the nitrogen concentration in the lake. If this is due to the influence of forest establishment several decades ago then the balance of the nitrogen target reduction load may already have been accounted for.

9 Rotokakahi update

9(a) David presented information on water quality in Lake Rotokakahi since the early 1990s. This shows decline in quality in the mid-1990s followed by significant changes in water quality in about 2007. This coincides with the forest harvesting which occurred at that time.

9(b) Paul White presented on groundwater and geology review for the Rotokakahi and Waipa Catchment. He mentioned that the recommendation from the groundwater expert (Hugh Thorpe) was to keep spray areas around the springs below the 340 metre contour. Note: it was later commented that the 340 contour was set by Thorpe in the area adjacent to the springs to avoid contamination of springs used for drinking water supply. Many blocks are above this contour; however Lake Rotokakahi is at a level of about 394 metres. Paul mentioned there is a small area where the highest spraying level is above 398 metre contour, but there is a relatively low risk of back flow to Rotokakahi from this area. At the highest spray levels the groundwater surface is considerably lower. Bore number nine which has not been installed as yet will assist in determining whether any flow can occur back to Rotokakahi.

John McIntosh presented his information on the Waipa levels and water quality:

- He mentioned that there are a number of reports that confirm flow from the Waipa Catchment to Lake Rotorua.
- He undertook a flow budget pre and post irrigation to determine flows.
- Undertook chloride budget and determined that chloride balances over time, it takes about 20 years for flows from the catchment to get down to the Waipa Stream.

- All evidence points to the RDC land treatment system discharging to the Puarenga catchment and to Lake Rotorua.

Action:

- **Paul to complete a proposal of investigation for the Rotokakahi Catchment and Waipa Catchment to assist in determining or eliminating potential sources of contamination to Lake Rotokakahi.**

10 Rotorua Lake model update

Deniz updated the group on the Lake model which has been run over the period 2004-2009. This is being extended to 2011. It is important to update the model as Lake Rotorua water quality is approaching the TLI specified in the Water and Land Plan and the Council is embarking on a $45M land use change package to reduce nutrient inputs to the lake. Council now needs to know the reason for this improvement in water quality and what's likely to happen in the future with changes in climate, weather and other interventions.

David mentioned that the weather during the 2011/2012 summer had significantly reduced stratification of the lake and was likely to be contributing to less nutrient releases. One of the tests which will be undertaken is the reduction in internal load.

It was discussed that the climate effect for the next ten years will be hard to predict however, a normalised climate for the last ten years could be used.

11 Rotorua de-stratification updated by David

David is undertaking some modelling work for a group from Ngāti Rangiteaorere who is looking at a major project around the eastern part of Lake Rotorua. This includes a lot of land management work but has a component of using geothermal energy to potentially de-stratify Lake Rotorua.

Note: The proposal does not involve discharge of geothermal fluid to Lake Rotorua but rather the heat from that geothermal fluid.

David had undertaken simulation of heat inputs to the Lake starting at 200 degrees Celsius and dropping to 90 after flow around a heat exchanger. Simulations of 1 litre/sec up to 100 litre/sec have no result in changing stratification. At 5 cubic metres per second it breaks stratification. This information has been passed on to the engineer for the group and David is awaiting feedback on that.

12 Tikitapu sediment work

Tikitapu sediment work from Chris Hendy was discussed in item number one on Tikitapu current monitoring.

13 Update on projects and funding shifting

Anna updated the group on funding changes in the Ten Year Plan. She mentioned that in the next ten years we are looking at 200 tonnes of nitrogen reduction with a budget of about $45M. She also presented the expected reductions in best management practice which will be forced by rule changes. See attached pamphlet. iv)

She also provided an update on the Ten Year Plan and Regional Policy Statement. Effectively funding from sediment capping, Hamurana diversion and sediment capping in Lake Rotoiti has been transferred through to boost land use change funding. The objective here is to provide funding for long term sustainable actions on land which will make any improvements in lake water quality more enduring.

14 Lake nutrient progress

Anna presented on lake nutrient progress. She stated that the Deed funding we now have from the Crown is more outcome focused and there is a need to link between dollars spent and nitrogen and phosphorus reduction to keep Ministry for the Environment satisfied that funding is being spent wisely. She was requesting that the TAG group peer reviews the reduction tables to give some rigour to information provided to Ministry for the Environment.

Action:

- **Anna to set up a running spreadsheet of nutrient reductions achieved for each of the lakes. Calculations on nutrient reductions will be provided by a suitable expert and then the spreadsheet circulated to TAG group for comment before taking to Ministry for the Environment.**

It's unlikely that this will coincide with TAG meeting and will be done via email prior to the necessary audits being sent to Ministry for the Environment.

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