

## WQTAG Water Quality Minutes

23 April 2015

---

### BOPRC- Te Wai Ariki Room

1125 Arawa St.

---

**Chair:** Andy Bruere (BOPRC)

**Present:**

- NIWA: Max Gibbs, , Kit Rutherford, Clive Howard-Williams
  - BOPRC: Paul Scholes, Niroy Sumeran, Alastair MacCormick, Stephen Lamb and Marcus Bloor (left early)
  - UoW: David Hamilton, Warwick Silvester, Chris McBride, Aroon Parshotam
  - RDC: Alison Lowe
  - Scion- Kim Grouther
  - DairyNZ- David Burger
  - Other: Gloria Zamora, Gang Pan (morning only)
  - **Apologies:** Rob Donald, John MacIntosh, Alastair Suren Chris Palliser, Piet Verburg
- 

### Action Summary for this meeting

- Item 3(a) WQTAG: to send comments on Rotokakahi report to David Hamilton by end of week.
- Item 3(a) Andy Bruere: to invite someone to explain methodology and practice around riparian harvesting in this area.
- Item 3(b) WQTAG: to get comments to Chris McBride on Tikitapu report within 2 weeks.
- Item 3(d) David Hamilton: to send Andy Bruere Wang Me report on sewage to circulate to WQTAG.
- Item 4(a) Chris McBride: to circulate source Excel file used to calculate lakes nutrient budgets.
- Item 4(a) WQTAG: to give feedback to Chris McBride on Nutrient Budget report and any additional information to plug into report.
- Item 6(c) Andy Bruere/Alison Lowe: to make changes to sewage statement to be circulated next week.
- Item 7(b) Andy Bruere: to contract someone to begin monitoring trout and kakahi in Lake Rotorua for alum sensitivity.
- Item 7(b) David Hamilton and Andy Bruere: to discuss actions to meet the alum report recommendations.
- Item 9(a) Andy Bruere/Clive Howard- Williams to put position paper together.
- Item 10(c) Andy Bruere: to get Rerewhakaaitu catchment boundary from John McIntosh.
- Item 10(c) David Burger: to circulate factsheet and webpage on Rerewhakaaitu farming.
- Item 10(c) David Burger: to locate OVERSEER® budgets from Martin Hawke.
- Item 11(c) David Hamilton and Andy Bruere: to set next SAG meeting for next month.

---

## Item 1: Welcome & Apologies Andy Bruere

---

### Item 2: Gang Pan

#### a) David Hamilton introduced Dr. Gang Pan

- Dr. Gang Pan presented on his research of 'modified local soils' (MLS) technology which turns local soil or sand into multifunctional materials for aquatic ecological engineering and Nano bubbles. With one spray of MLS onto the polluted waters, it can remove toxic algal blooms in either fresh or sea waters, remove dissolved and particulate pollutants (nutrients, metals, organic matters, and colloids), improve water clarity, reverse the anoxic condition and reduce the internal nutrient release from the sediment, and finally lead to the restoration of submerged vegetation in shallow waters so that the short term water quality improvement effect becomes sustainable.
- Currently looking at how to go from lab to a full scale project.
- Research is a cooperative study and independent assessment with University of Waikato.
  - i. Research is looking at how long oxygen nanobubble MLS technology can work in simulated local lake system.
  - ii. One additive for the modification is cornflower.
  - iii. Has been trialled in Taihu and 30,000m<sup>2</sup> pond.
  - iv. Tests showed after one day that Chinese soil was effective in flocculating the water.
  - v. May trigger series of physical, chemical, biological, and microbial processes for lake restoration.
  - vi. May be ideal to target stratification periods on an annual type basis.
- Outcomes still to research
  - i. Is it applicable to a longer period of time?
  - ii. Surprised that it has been a stable change, rather than a short term solution. It remains oxygenated. One trial in Beijing oxygen effect lasted nearly 1 year.
  - iii. Possible proposal to experiment on campus lakes which will give an accurate idea if technology will be feasible for wider use in NZ.

#### b) Questions/Discussion:

- Does modification process require bringing materials from China?
  - i. Not necessarily. Possible to do everything from here, best results may need to bring material from China.
- Ongoing work- get paper together for scale up experiment part which will most likely be using campus lakes to get an idea if feasible in New Zealand.
- What is issue you see with storm water?
  - i. An alum flocculation application was completed in campus lakes which had fantastic results; however, 20 days later there was a storm event and lake was back to normal.
  - ii. Need to find out if this material will have longevity even in the event of a storm.
- Is it possible to dose more often rather than a few times a year?
  - i. Yes, it is completely safe and that can be looked at.

- China is currently looking to invest in fresh water quality research approximately 1 trillion dollars.
  - China is interested in collaborating with NZ and talks have been really positive and currently waiting to hear from central government on proceeding.
    - i. Dr. Pan is creating a pilot test to for the collaboration.
    - ii. Bench trials have been completed and are now being written up.
    - iii. Looking to collaborate with in Canterbury to scale up project.
    - iv. Batch tests are based on Chinese local soils at this point. UoW, NIWA, BOPRC and Canterbury recipe can be changed for NZ soil. It changes from city to city and needs to be manipulated to use local un-polluted soils.
- 

### Item 3: Model Updates

#### a) Rotokakahi – David Hamilton

- Not a public lake, iwi owned and was last monitored in 1996 after which it was closed to public. Joseph Butterworth monitors the stream exiting the lake.
  - i. Lake SPI shows it has less invasive weeds than other lakes in region which is most likely as a result of lack of boats on lake.
  - ii. Mr. Butterworth has found that there is very significant thermal anoxia and internal waves which are dictating the bottom distribution of mussels.
  - iii. In 2007 there was a logging program around the surrounding forest which impacted the lake water quality. DH attempted to identify harvesting times more clearly but this was difficult to be certain. At that time production trees were planted in the riparian areas and harvesting disturbed the sediments in these areas. Much of the land has been protected by riparian margins now.
- Alignment of lake faces east/west and is quite narrow. 32 m maximum depth in some of the basin which could be the reason that simulation is not as precise as other lakes.
  - i. Rotokakahi is fairly sheltered, however on one side it isn't.
  - ii. This season we've had algae issues on a number of lakes, Rotokakahi was up to red alert but did not get health warning as it is not a public lake
  - iii. Lot of Ceratium (algae) which sometimes swim up to surface and accumulate pushing into the stream which then flows to Lake Tarawera hence the algae issues this year, and also identified in Lake Tarawera
- Questions/Discussion:
  - i. Was there any nitrate increases this year?
    - 1. Yes, slight increase but mostly P as lake is completely anoxic 3-4 months a year.
  - ii. What time of day were samples taken?
    - 1. Between 10 am-3pm. The times are highly variable due to access issues.
  - iii. Will the rejuvenation of forestry land help with the lake?
    - 1. Yes, that's probably contributed to some of the change we are seeing now and there are 3 long-term GW monitoring sites on nearby farms.
  - iv. What are regional rules around riparian harvesting?
    - 1. The care taken here was a lot much more than other harvesting. Some areas were selectively logged by helicopter.

2. If forestry harvesting around the lake it will need to be done in stages this may be a simple way around the issue.

**ACTION:** WQTAG: to send comments on Rotokakahi report to David Hamilton by end of week.

**ACTION:** Andy Bruere to invite someone to explain methodology and practice around riparian harvesting in this area.

**b) Tikitapu report- Chris McBride**

- Interesting discovery on impact of silica on algae species in the lake: Chris Hendy monitored the thickness of organic sediment and was concerned that it could affect silica limitation in the lake. The lack of silica in the lake limits the presence of diatom algae, leading to the characteristic “blue” lake colour.
- Although Tikitapu is a bit anoxic in bottom waters it is stable which is most likely the result of the shape of the basin.
- Feature of this lake is a deep chlorophyll maximum at about 20 meters.
- Questions/Discussion:
- Will we relook at how model is working since the sewage reticulation in 2010?
  - i. Yes, we have to decide how to parameter it due to attenuation.

**ACTION:** WQTAG: to get comments to Chris McBride on Tikitapu report within 2 weeks.

**c) Ōkaro- David Hamilton**

- Ryan Mallet completed MSC.
- The plan now is to develop some scenarios using INCA model to test land use scenarios. Meeting planned with farmers to decide on some long term options.
- Embarking on running scenarios on wetland performance and detention bunds performance,
- David Hamilton doesn't believe the scenarios that have been run were as sophisticated as what needed to be.
  - i. Chris McBride has recently been working with the INCA model and it looks like a more promising tool in prediction of daily nutrient loads and discharge. We can load more nutrients accurately and it gives more accurate details.
  - ii. You would not go to an individual farm scale with the INCA model as it is a catchment base model.

**d) Rotorua sewage LTA- David Hamilton**

- There are 3 main soil types in irrigation blocks.
- The data set was very good and so Wang Me was able to get exceptional results on the model performance.
- Modelled 9 scenarios.
- Forestry harvesting shows peaks of P loading.
  - i. Forest harvesting is the biggest issue for P.
- Effects study is underway to look at different options for wastewater discharge. The switch of weekly irrigation of each block to daily over 7 days has been beneficial in reducing N leaching.

**ACTION:** David Hamilton: to send Andy Bruere circulate Wang Me report to WQTAG

**Item 4: Update on the 12 Lake nutrient Budget**

- a) Draft report circulated titled “Estimates of nitrogen and phosphorus loads to twelve BOP lakes”.
- OVERSEER® has been used where available, where not available regional average has been used for land-use type.
  - Literature surveys were used to calculate geothermal loads.
    - i. Same process was used for all 12 lakes.
    - ii. Criteria can be found on pg. 18 of report.
    - iii. Paul White GNS may be able to give additional information on Lake Ōkāreka.
  - An established method for estimating nutrient loads to lakes is the estimation of nutrient loss rates from land uses within the catchment, multiplied with land use area in order to calculate total ‘loads-to-lake’. This method considers steady-state (long-term average) nutrient loads.
  - Report is meant to drive the internal loads report (NIWA) and is a just a point of reference.
  - Geothermal loads are quite significant for some of the lakes but are still uncertain which has highlighted the need for additional research.
  - In regards of N:P ratios, Lake Rerewhakaaitu is still an outlier.

**b) Questions/Discussion:**

- Can we line this up with/when we run ROTAN?
  - i. Possibly with Lake Rotorua.
  - ii. This is one of several approaches; the goal is to apply the same methodology across all of catchment.
- Do we know groundwater lag times for other lakes?
  - i. No

**ACTION:** Chris McBride to circulate source Excel file used to calculate lakes nutrient budgets.

**ACTION:** WQTAG: to give feedback to Chris McBride on Nutrient Budget report and any additional information to plug into report.

**Item 5: ROTAN re-programme and Attenuation work- David Hamilton**

**a) Re-write of ROTAN programme**

- An agreement is in place with the University of Waikato to re-write the source code for ROTAN to run on available ARC GIS system.
- Plan of work for the application of ROTAN to support Lake Rotorua nutrient budgets was circulated in memo and spread sheet.
- This has become a critical project to support the rules framework and Stephen Lamb attended this part of the meeting to explain the significance and risk if this info is not available.

**b) Attenuation with the new OVERSEER® outputs – Alastair MacCormick and Kit Rutherford**

- Task has been taking the target and translating it to the rules.
- The new OS programme has changed dramatically the predicted farm outputs.
  - i. Groundwater boundary has changed.
  - ii. Some sector changes since 2001/2004

- iii. Need to balance the 435 t N again with these changes and be able to explain to the community. This may be explained by attenuation but need support to clarify that.
- BOPRC about to notify rules in August 2015 and need to be prepared for challenges. Experts have said the debate is likely to be around modelling.
  - i. Stephen Lamb would like to re-run the numbers as not a science review but as a methodology review to prove the numbers still add up and methodology can be confirmed.
  - ii. Can WQTAG confirm the methodology and the detail come later?
- Inputs to ROTAN will be different this time
  - i. OS 6.1.3 shows about 45 to 50 % difference, and version 6.2 will change outputs again.
  - ii. Need to understand attenuation as versions change and clarify how that will be handled.
  - iii. Spreadsheet shows the existing data minus benchmarked data and doesn't cover whole catchment other data has been extrapolated out. From there the methodology has been applied and attenuation is showing around 30 - 35%.
  - iv. Need a methodology that is consistent throughout each version of OS and is consistent for farmers.
- Best fit line chosen is the groundwater change that affects the least amount of land.
  - i. Waikato farms in groundwater catchment cannot be subject to rules.
  - ii. Kit Rutherford and Alastair MacCormick have come up with 2 methods to estimate attenuation.
- Kit Rutherford would like to know if the reduction target set with the community is absolute. Once that is clarified next step becomes more obvious.
  - i. Then will need to take 50% increase N factor on board.
  - ii. WQTAG can go back to 435tN and ROTAN and keep to the reductions to establish how to get to 435tN target.
- WQTAG would like the policy team to give the starting point.
  - i. If 435t is the correct target then, why are we not looking at allocation of the 435 t rather than reduction then attenuation wouldn't matter. Then work up from there to where the load is today flowing to the lake.
- **Questions/Discussion:**
  - i. We can still rely on numbers from OS 5.4 and get an un-attenuated number with no further modelling.
  - ii. Would we be running model with every change of version of OS?
    1. Depends on how attenuation is dealt with.
    2. In regards to 435tN, is there any reason why it would change through the process as it never depended on OS, but was contrived with historical data? Kit confirmed that it did not rely on OS and still stood as the best estimate to date.
  - iii. Steps needed
    1. Stage 1- Work out attenuation estimate and scale up for new OS loads.
    2. Stage 2- fix all data with ROTAN re-model

- a. If agreed to use above process, than Alastair MacCormick can work with Kit to get attenuation numbers aligned.
  - b. Attenuation will be simply for both non-pastoral and pastoral and can be completed by 30 July 2015.
- iv. How much change in OS will trigger ROTAN re-run?
1. This needs to be looked at
- Integrated Framework loads:
    - i. Where is septic tank load in that number?
      1. 30 t N RF- no attenuation
      2. 30 t N sewage- no attenuation
      3. 280 t N pastoral- attenuated
      4. ? Urban/septic- attenuated
      5. 70 t N forest/bush- unsure of attenuation
  - Definition of attenuation: in the difference between what leaves the root zone and that measured reaching the streams and lake.
  - Discussed that attenuation is not an average it differs farm to farm. It could be affected by the time of travel in the ground water and so it could be complicated by different age GW in the catchment. This was not an issue when attenuation was zero or low but now it becomes more complicated.

**ACTION:** WQTAG to come back with methodology used to calculate target loads.

**ACTION:** Kit Rutherford and David Hamilton to decide who will re-run the ROTAN model.

#### **Item 6: Sewage Statement- Andy Bruere**

- a) A draft has been circulated and discussed; WQTAG needs to decide on action forward.
- b) Goal was to provide a constructive statement that avoids political implications.
- c) Change requests from RLC
  - Would like some mention if statement allows for urban growth and to look at wastewater as a whole not just the discharge to allow for reticulation of septic tanks. Policy as is doesn't encourage reticulation.
  - A statement put in to recognize the fact that there is cross catchment movement of nutrients.
    - i. You can't offset reductions from one lake to another lake although we accept that nutrients are flowing to other lakes.
- d) Concern re N release over future years from the LTS. SCION has done research to indicate that after 4-6 years the site will be at equilibrium.

**ACTION-** Andy Bruere/Alison Lowe to make changes to sewage statement to be circulated next week.

#### **Item 7: Alum dosing protocol update**

- a) Update on Rotorua and Rotoehu alum dosing- Niroy Sumeran
  - BOPRC needs some direction for WQTAG on the following questions:

- i. Concern re dosing rate at Rotoehu: Should we continue with current rate of 45 l/hr?
- ii. Is it too much alum for what we are achieving?
- iii. Should we be doing weed harvesting earlier to allow flow out of the Waitangi Stream and prevent pH increases that release P?
- iv. Should we change the dosing protocol to just meet the P coming down stream and nothing more? Or turn off in winter? Or continue as is?

**WQTAG Recommendation:** to continue alum dosing as is and to consider weed harvesting earlier in year.

- Chris McBride questioned if WQTAG is admitting that alum dosing is affecting the lake by the protocol?
- Alum: the recommendations and monitoring from David Hamilton's modelling report and slide from Grant
  - i. Need to set in place additional eco-monitoring
  - ii. Undertake nutrient limitation analyses in Nov and Feb annually,
  - iii. Investigate pH at buoy for any effect,
  - iv. Look into development of dynamic model to assess the impact of alum more specifically,
  - v. Look into the details of VHOD changes,
  - vi. Figure 20 shows clearly that there is way too much alum for in stream treatment alone.
  - vii. Recommendations find out what are the sensitive species.
  - viii. We know that fish are the most sensitive.
- This summer kakahi moved from deep water to shallow water and as a result died. The lack of oxygen may be a greater environmental influence than alum.
- Should we have a protocol that identifies stratification issues and pre-empts P release? – Andy Bruere

**ACTION-** Andy Bruere: to contract someone to begin monitoring trout and kakahi in lake for alum sensitivity.

**ACTION-** David Hamilton and Andy Bruere: to discuss actions to meet the alum report recommendations.

**WQTAG Recommendation:** Do not alter alum protocol in response to stratification.

#### Item 8: Rotorua sewage update

##### a) RDC sewage steering committees – Alison Lowe

- Rotorua Steering committee was held 22 April 2015
- RLC is looking to incorporate TERAX for the solids and integrating with the WWTP.



- Terax issues-
    - i. Maybe increase in colour of output
    - ii. Could have issues where alum is dosed to reduce P
    - iii. Alum taken back with the sludge alum may strip the plant
    - iv. Risks have been worked through and mitigation options and now cost is be reanalysed. Business case is now on hold. 6 weeks to decision being made.
  - RLC is looking at 5 main areas for discharge. Criteria being considered are the following: distance from treatment plant and slope. University of Waikato is looking at the environmental effects on this discharge to water locations.
  - Steering committee has asked RLC for more information on Reverse Osmosis, at this point cost is approximately \$80-90 million.
- b) b) Rotoiti and Rotomā sewage
- Current sewage solutions being consulted on:
    - i. Lake Rotoiti- biolytic using onsite prior to reticulation subject to trial
    - ii. Rotomā- will have grinder pumps then to central treatment plant( MBR).
    - iii. Rotoehu- No decision yet but options include OSET or could have own scheme cost is \$22k-40k/household up to \$57k/household pre-subsidy.
      1. Still trying to get reticulation.
      2. If no subsidy, public will question cost of \$57k.
      3. Site being considered is behind Emery store in Rotoiti catchment. If site can't be agreed on then RLC will be pumping back to Rotorua.
      - 4.

#### **Item 9: Aquatic weeds and Lake SPI**

- a) Position paper on-hold until next TAG meeting, discussion on need for position statement.  
**ACTION:** Andy Bruere talk to Clive Howard- Williams to put position paper together.

#### **Item 10: Rerewhakaaitu**

- a) High-frequency buoy Update in Lake Rerewhakaaitu – Chris McBride
- Moorings are now in place.
  - Plan is to get remaining gear in next week.
- b) David Burger to bring report to next WQTAG meeting on Rerewhakaaitu farmers projects.
- c) Rerewhakaaitu model maybe ready for discussion (David) deferred
- Farmers are in charge of their own action plan.
    - i. 31 farms in catchment, 10 farmers leading the way
  - The lake is at its TLL; however, nitrate is up significantly.
  - David B to locate OS budgets from Martin Hawke

**ACTION:** Andy Bruere to get Rerewhakaaitu catchment boundary from John McIntosh.

**ACTION:** David Burger to locate OVERSEER® budgets from Martin Hawke.

**ACTION:** David Burger to circulate factsheet and webpage on Rerewhakaaitu farming.

#### **Item 11: Detainment bunds verification**

This topic has been deferred to next meeting.

**Item 11: Other Business**

- a) Land TAG update
  - Land TAG is working on prioritizing research topics.
  - Next LandTAG meeting is 6 May 2015.
- b) Science Plan
  - It's time to review and include land science priorities.
- c) SAG Update
  - Next SAG will be discussing the following topics:
    - i. Nano bubbles
    - ii. Timing of the next Ōkaro Alum dose
    - iii. Rotorua benthic chamber work
    - iv. Sediment core efflux
    - v. Adding aeration to Lake Rotoehu.

**ACTION:** David Hamilton and Andy Bruere to set next SAG meeting for next month.

- d) Inter-lab comparison progress deferred to next meeting. Paul Scholes