Notes: Water Quality Technical Advisory Group, 11 Dec 2017

Bay of Plenty Regional Council – Te Wai Ariki, 1125 Arawa St, Rotorua, 9:30 am

**Convener:** Andy Bruere

**Present:** Andy Bruere, Piet Verburg, Paul Scholes, David Hamilton, Keith Hamill, Max Gibbs, Alison Lowe, Chris McBride, Paul White, Joe Butterworth, Troy Baisden, Warwick Silvester, Kim McGrouther, Joe Butterworth, Abby Harding, Niroy Sumeran (10:30 am – 1:30 pm), Alastair MacCormick (2:00pm onwards)

**Action Summary:**

Action 1 - Andy Bruere to invite Caroline Reid to the next Water Quality TAG meeting to discuss Overseer Model.

Action 2 - Andy Bruere to follow up on Grant Tempero’s phytoplankton limitation proposal as to whether it has been finalised (PC10).

Action 3 - Andy Bruere circulate brief of what people are doing (Work modules) in relation to the requirements of the Science Review Terms of Reference (timeframe mid-late January).

Action 4 – Item 2 - David Hamilton to provide Queensland WQ Network Good Modelling practise Document for circulation to TAG.

Action 5 – Item 3 – Joe Butterworth to pass Paul White’s contact to Te Arawa Lakes Trust to help provide details of Waiotapu Lakes Management

Action6 - Item 3a – Paul Scholes to look at nutrient analysis issues with respect to testing the made up samples, compare filtration and approach laboratories to notify regarding issues, add nitrogen samples to the comparisons, and, include the Rotorua Lakes Council lab in the comparisons.

Action 7 – Item 3c – Troy Baisden and Andy Bruere to discuss how they may be able to develop the Takiwa project funding and take the software forward. How can farming and community engagement be included?

Action 8 - Item 4a.i – At the next Sediment TAG meeting discuss Alum dosing options for Lake Rotoehu.

Action 9– Item 4a.iv - Provide information on MicroNano bubbles to next TAG from Max Gibbs or the Auckland suppliers.

Action 10 – Item 4a.iv – Andy Bruere to add Lake Ōkaro and Rotoehu to the next Sediment TAG Agenda - Discuss options around how Ōkaro can be managed and include the catchment and lake modelling that Mat Alan is doing.

Action 11 – Item 5a – Max Gibbs to scope a project to determine where the sediment source is for the Waitetī Stream.

Action 12– Item 5a – David Hamilton to provide Jamie Puryer-Fursdon and Jonathan Abell’s sedimentation research for circulation to the TAG.

Action 13– Item 7a – David Hamilton to prepare draft paper on climate change and identify main points which can be taken to the councillors. This will form the next TAG statement on climate change and we will circulate it for TAG comment before the next TAG meeting.

Action 14– Item 7a – Andy Bruere to Invite Michelle Lee to the next WQTAG meeting to discuss climate change mitigations.

Action 15– Item 9a – Alastair MacCormick to distribute report (Evaluation of options for nutrient reduction in Rotorua - Jo McQueen, Wildlands) for comment. Look at bringing in alignment with P. Put a table of the evaluation in the introduction (shift all of the rejected options into an appendix).  
Action 16– Item 10 - Alastair MacCormick to distribute Tarawera conceptual plan Excel model to the TAG.

Action 17– Item 10 – Alastair MacCormick to talk to Troy regarding assistance from student for the Tarawera conceptual plan project.

Action 18– Item 12 - Andy Bruere to add items to take to the next Sediment TAG Agenda: Lake Ōkaro, Lake Rotorua Sediment report and Lake Rotoehu.

Action 19 – Item 12 – Project for the future: Update the Lake Rotoiti model to include inflows into the lake from leakage through the wall or with the wall removed.

Action 20 – Item 12 – Andy Bruere and Troy Baisden to discuss options for creating a gate in the Ōhau Channel Wall to aid in aeration of the lake bottom waters at times.

Action 21 – Item 12 – Andy Bruere and Jo Butterworth to discuss water quality management around Lake Rotomā and other lakes.

**Item 1: Welcome, apologies and minutes /**

**Apologies:** Chris Eager, Clive Howard-Williams, David Burger

* Welcome to Jo Butterworth, Troy Baisden, and, Abby Harding
* Chris Eager’s thesis presentation postponed to a sediment TAG meeting.

**Item 2: Actions from previous session (29 June 2017)**

**Follow up on Action items from previous minutes:**

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| --- | --- | --- |
| Summary of actions from Water Quality Technical Advisory Group Meeting – 29 June 2017 | | |
| **Item Number** | **Action Point** | **Action or person responding** |
| 2 | From previous meeting actions: 4b – Andy Bruere – add agenda item for next meeting “cyanobacteria monitoring for Lake Rotoiti – area affected by Ohau Wall”. Discuss with Alastair Suren and arrange monitoring in the area for the 17/18 Summer. | *Closed*  *Paul Scholes now looking into previous phytoplankton monitoring (for all phytoplankton sp.)* |
| 2 | From previous meeting actions: 4b – Paul Scholes to assess existing data held for Phytoplankton samples in the area of the Ohau wall | *Paul Scholes to follow up on preserving phytoplankton samples in the area of the Ohau Wall.* |
| 3a | Action 1 – David Hamilton to consider addition of a chart that shows nutrient load broken down by source and a map depicting where groundwater is going to in the Lake Rerewhakaaitu catchment report. | *David H - Completed in final report* |
| 3a | Action 2 – Andy Bruere to arrange for David Hamilton to present to Lake Rerewhakaaitu catchment farmers in September. | *Closed* |
| 3b | Action 3 – Andy Bruere to find out who is on the national group assessing the Overseer model for use in regulation and see how an approach could best improve access to the model workings so the outputs could be more clearly understood. | *Closed*  *Action 1 – Caroline Reid to come to the next WQ TAG meeting.* |
| 5 | Action 4 – Piet Verburg to email Grant Tempero with feedback on the design of the research proposal on seasonal phytoplankton nutrient limitation in Lake Rotorua | *Closed*  *Action 2 – Andy Bruere to follow up on Grant’s proposal as to whether it has been finalised (PC10).* |
| 6 | Action 5 – Item 6 – WQTAG members to email Andy Bruere if they have any questions on the position paper. | *Closed* |
| 9 | Action 6 – David Hamilton **to provide summary climate change statement by 29 July 2017 and supply to BOPRC** | *See Agenda Item 7* |
| 11c | Action 7 Chris McBride to calculate winter dose rate to DRP requirements in stream based on historical averages. | *See Agenda Item 4* |
| 11c | Action 8 – Niroy to look at protocols for dosing in each stream and report back to WQTAG. Look to switch dosing levels between streams. | *See Agenda Item 4* |
| 11c | Action 9 – Andy Bruere to engage with RLC on assessing and managing current and future alum dosing flows to address P at the wastewater treatment plant. | *See Agenda Item 4b* |
| 11c | Action 10 – Niroy will report back to WQTAG after Chris’s Master’s thesis is completed and consider inviting Chris to speak at next WQTAG meeting. | *Closed – See Agenda Item 4* |
| 11d | Action 11 – Andy Bruere to circulate draft confidential assessment of requirements of science review Terms of Reference to workshop attendees. | *Closed*  *Action 3 – Andy Bruere circulate brief of what people are doing (timeframe mid-late January)* |
| 11d | Action 12 – Andy Bruere to convene TAG sub-group workshop |
| 11d | Action 13 – Paul Scholes to share the data collected in the 2016 sampling with David Hamilton. | *Closed* |

*Discussion over the limitations and issues with OVERSEER:*

*The TAG expressed some concern regarding the transparency of OVERSEER model. Ideally models used in the public arena should be open to scientific scrutiny to reassure the public and allow ongoing contributions to advancement of the model. David Hamilton recently met with OVERSEER owners and discussed this issue. Caroline Read will come to a future TAG meeting to discuss further.*

* David raised the Queensland WQ network ([Good Modelling Practise Document](http://www.rotorualakes.co.nz/vdb/document/1600)). This document recognises some of the issues with [models](http://www.rotorualakes.co.nz/vdb/document/1599) and how to approach them.

Action 1 – Item 2 - Andy Bruere to invite Caroline Reid to the next Water Quality TAG meeting to discuss Overseer Model.

Action 2 – Item 2 - Andy Bruere to follow up on Grant Tempero’s proposal as to whether it has been finalised (PC10).

Action 3 – Item 2 - Andy Bruere circulate brief of what people are doing in relation to the requirements of the Science Review Terms of Reference (timeframe mid-late January).

**Action 4 – Item 2 - David Hamilton to provide for circulation the Queensland WQ Network Good Modelling practise Document**

**Item 3: Model updates**

* Te Arawa Lakes Trust requested more information on the action plans for the lakes that aren’t discussed as much (e.g. Lake Rotomā). To discuss further in Item 11.
* Question raised as to whether Te Arawa Lakes Trust include Lakes Ngapouri (Waikato), Ngahewa (Waikato), and Tutaeinanga (Waikato)
* Suggested the Lakes 380 Programme may be useful for Te Arawa Lakes Trust. This programme assists with prioritising lake management.
* Determined that the Waiotapu lakes are managed by Waikato Regional Council.

1. **Tarawera and the Tarawera Farm Plan project and Laboratory Comparison statistics**

*Presentation and discussion over variations in Laboratory results:*

* Biggest questions raised are around nutrient concentrations (e.g. TP) and understanding what the findings mean. There were variations between the laboratories results that need to be looked into further.
* There will be a national study comparing variations and discrepancies between laboratories.
* Current laboratories compared were Watercare, Hills, NIWA, TMI, BOPRC, and Eurofins
* The deviation between Laboratories was compared and discussed.
* Questions raised around what the next step is following these findings. Decided that the laboratories need to do inter-lab comparisons.
* Paul Scholes will send some standardised samples for further comparison.
* Discussion around whether samples should be filtered in the laboratory or field and how this may influence results. Normal procedure is that samples are left unfiltered in the field. Transportation time was thought not to influence results.

1. **Ōkāreka**

* Catchment modelling complete and lake modelling being undertaken.
* Need to consider what scenarios will be looked at in conjunction with the community.
* Consider climate change aspect, water outflow variability, lake level variation, and land use change.
* This work has been undertaken because the actions in action plan are complete such as sewage reticulation, land use change etc. and the lake is not meeting its TLI target.

1. **Takiwa**

* Demonstration of Takiwa <https://lakes.takiwa.co>
* This is available publicly with a free log in
* There is no more funding for this project. Project is completed. Future funding may be necessary to ensure the project is updated.

**Action 5 – Item 3 – Joe Butterworth to pass Paul White’s contact to Te Arawa Lakes Trust to help provide details of Waiotapu Lakes Management**

**Action 6 - Item 3a – Paul Scholes to look at testing the made up samples, compare filtration and approach laboratories to notify regarding issues, add nitrogen samples to the comparisons, and, include the Rotorua Lakes Council lab in the comparisons.**

**Action 7 – Item 3c – Troy Baisden and Andy Bruere to discuss how they may be able to develop the Takiwa project funding and take the software forward. How can farming and community engagement be included?**

**Item 4: Alum Dosing**

1. **Rotoehu**
2. **Presentation from David Hamilton on Chris Eager’s MSc work**

*Discussion covered the following topics as paper “Biogeochemical Characterisation of an Alum Dosed Stream: Implications for Phosphate Cycling in Lake Rotoehu” (paper not available for distribution at this stage):*

* Macrophyte beds (hornwort) are seen to contain the geothermal water which has elevated temperature. The hornwort will be taking up carbon and influence extremes in pH (notably high pH). Extremes in pH can result in reduced floccing capacity of Alum.
* Weed harvesting in the past appeared to be quite effective. Weed beds are present this year. However, growth has reduced and is approximately 2 m below the surface. Algal blooms may be supressing the growth of weed. The weed harvester will only pick up weed 1.5 m below the harvester.
* Alum dosing is evidently not working without weed harvesting. Need to consider other alternatives to Alum dosing.
* Land use change is being implemented in the Rotoehu catchment
* Suggestion of extracting the phosphorus with something that could cope with the pH of the lake as the macrophytes do. This could be a potential area of research.
* Phoslock suggested. Phoslock was tested in Lake Ōkāreka in 2004. Issues that it may impact fish and benthic biota. Large problem with Phoslock is the cost.
* Filtration suggestions discussed.
* Questions around whether cyanobacteria/ algae harvesting is an option.
* Algae harvesting has been trialled and the concentration in our lakes was not high enough to be useful.

1. **Update on alum dosing at Soda Springs**

*It was reported that:*

* Dose rate has been reduced to 20L/ hr to reduce cost.
* Three times the rate of alum has been put into Lake Rotorua as what has gone into Rotoehu and the results have not been as effective for Rotoehu as in Lake Rotorua.
* Option of using Diquat or the weed harvester to reduce the influence of weed growth on the alum dosing. As discussed previously, the hornwort beds this year are too low for the weed harvester to reach.
* High amounts of iron within Soda Springs Stream. Iron will bind to P sediments before alum however, iron may re-release in anoxic environments.
* Questions as to whether the dosing site is part of the issue. Discussion around potential shock dosing and direct application into the lake. Shock dosing was a less favourable option due to the large quantities of chemical that would be required and the implications of this. Preference was given to the suggestion of whole Lake System management including land use change and sewage reticulation. These aspects need to be addressed future sediment TAG meetings.
* Characteristics of Lake Rotoehu also influence the effectiveness of many P management options.
* pH monitoring stations will be set up in Te Wairoa Bay over the 17/18 summer to assess the Soda Springs discharge dosing station.

1. **Next Steps**

The next steps involve understanding the implications of Chris Eager’s research and looking into solutions for Alum dosing at different locations.

1. **Ōkaro**

*Discussion covered management options for Lake Ōkaro, in particular how to reduce anoxia:*

* [MicroNano bubble](https://www.dropbox.com/sh/d1ywyihtribmx4c/AAB57x1lqcWDBKsVLuJS1fava?dl=0) technology suggested. MicroNano bubbles are an oxygenation system for lakes and large water bodies that prevent hypoxic conditions in the lake. The micro bubbles sink (when they are below a certain size ratio of surface area to size increases) and settle into the sediment. Cost effectiveness questioned. They do not reduce stratification.
* Options of using the old de-stratifying machines from Lake Rotoiti, but not suited to aeration of hypolimnion that would be needed in a stratified lake.
* Te Arawa Lakes Trust has concerns regarding alum dosing in particular with the recurring issue of unknown long term chronic effects on lake biota. Requested further research into this.
* Improvements to lake water quality need to be matched to the land use surrounding the lakes, considering costs, and implications of putting chemical into the lakes.
* There needs to be increased community involvement in the future in order to aid them in understanding their impacts on the surrounding lakes. This links with the aim to model the catchment and lake so that land owners can see the impact of land use change scenarios.

1. **Alum dosing Rotorua**
2. **Update from Niroy**

*It was reported through* [*PowerPoint presentation*](http://www.rotorualakes.co.nz/vdb/document/1613) *that:*

* The old dosing protocol from November last year identified that dosing rates in Lake Rotorua needed to be reduced. However, this was disregarded (on the advice of TAG) and instead dosing rates were fixed. The dose rate has been set at 150L/per hr this year. Lake Rotorua has already stratified this year which is earlier than usual. Since these changes to the dosage have been in place P concentrations have not gone above the control bands.

1. **Update on re-consenting**

*It was reported that:*

* Dosing consents expire in Sep 2018 the re-consenting process is currently underway.
* In the re-consenting we may need to portray the success of alum dosing on Lake Rotorua. Demonstrating what condition Lake Rotorua would be in if no Alum dosing had been undertaken.
* Presentation and discussion of Chris McBride’s Alum Dosing [PowerPoint Data](http://www.rotorualakes.co.nz/vdb/document/1612)

Action 8 - Item 4a.i – At the next Sediment TAG meeting discuss Alum dosing options for Lake Rotoehu and cycling.

Action 9 – Item 4a.iv - Provide information on MicroNano bubbles to next TAG from Max Gibbs or the Auckland suppliers.

Action 10 – Item 4a.iv – Andy Bruere to add Lake Ōkaro and Rotoehu to the next Sediment TAG Agenda - Discuss options around how Ōkaro can be managed and include what Matt Alan is doing.

**Item 5: Sediment Dredging**

1. **Sediment Samples**

[*PowerPoint presentation*](http://www.rotorualakes.co.nz/vdb/document/1605) *demonstrated sedimentation occurring at the mouth of the Waitetī Stream. Matters discussed included how to approach this issue:*

* Waitetī Marae came to BOPRC regarding sedimentation in the Waitetī Stream.
* Delta formations of sedimentation are occurring. Not clear if this is coming from the lake or the stream and whether it is a permanent change or shifting with time.
* Question of whether dredging could be an option around the Waitetī and Utuhina streams where there has been sediment build up. Idea of whether this could benefit removing some of the phosphorus from the lake. Some sampling has already been conducted. The issue has been brought forward to TAG to determine what the dynamics are within the lake that might be influencing this sedimentation cycling. Nearby land owners thought this sedimentation resulted from land use in the catchment. However, this need to be looked into further before any conclusions can be made.
* Options to remove the sediment could be dredging, suction dredging or potentially spraying vegetation to allow the sediment to move.
* Sampling at this stage has been at five sites to try to understand the nutrient content and significance of the sedimentation. Samples taken include:
* Water depth to sediment level (varies from 0.16 – 0.5 m deep)
* Releasable P averages 150mg/kg dry weight
* N content fairly low
* Dry matter composite sample 71% dry matter
* Estimated from mapped area that if sediment is removed to 500 mm deep approximately 3350 m3 of material would be removed. If the average TRP 150mg/kg dry weight then, with account of sediment density, at one location 350-550 kg TRP could be removed.
* How significant is this if sediment is removed? If we remove sediment from one area we may need to remove it from other areas because of community pressure. Also if this sediment is recirculated from the lake will removal make any difference?
* Before any removal of sediment can occur the source needs to be determined. How do we know whether it is coming from the catchment (and which part of the catchment) or the lake itself? Is it being recycled within the lake?
* Method available to determine the origin of fine sediments is compound specific isotope techniques. The results will show higher levels of phytoplankton and aquatic plants if the material has been recycled within the lake vs. land base sources if it originates from the catchment.
* In order to determine if the P is available within the sediment. When there is a sediment layer built up in the lake underneath the surface sediment that is oxic, the lower sediment becomes anoxic and there will be diagenesis where the P migrates to the surface. This means that the high concentrations of P will be in the top 10 - 50 cm of sediment. A sliced sediment core sample will be needed to determine the P concentrations through the core.
* The lake edge in the area is thought to be fairly stable due to vegetation.
* Sedimentation may be naturally occurring due to wind driven and water movement.
* Questions around the geomorphology of the lake and whether removing sediment deposits may cause erosion in other sites.
* [Sedimentation study](http://www.rotorualakes.co.nz/vdb/document/1614) has previously been completed by Jamie Puryer-Fursdon and Jonathan Abell (David Hamilton to distribute) in the Waitetī Stream looking at the sedimentation gradient of agricultural soils within the lake.
* Water level in Lake Rotorua is controlled more than what it would have been 20 -30 years ago. Previously greater variation in lake levels would result in beach formation and erosion of some areas. However, this year there may be higher sediment movement with higher rainfall.
* Questions for TAG:
* Isotope investigations can be completed at NIWA or Australia for sediment source tracing. Max Gibbs will work with NIWA on this.
* Is this a P issue or a sediment build up issue? For iwi it is a sediment issue. For BOPRC and TAG it is a P issue.
* Is this going to aid us at all with decreasing P in the lake? It will need to be determined where it is coming from at the source. Mitigations can then be managed at the source to reduce the sediment load going into the lake.
* Discussion over what can be done if sediment is sourced from agricultural areas. Are detainment bunds a viable option to mitigate this sedimentation build up in the lake? Massey University student PhD research on detainment bunds with John Paterson.
* Concerns raised over potential P plume coming down into the lakes from heavily fertilised agricultural land and eroded sediment within the catchments.
* It was originally thought that sediment loaded with P was inert when it hit the lake. It has been determined that once the sediment gets to the lake it is reworked once it hits the anoxic waters and then may release the P.
* Te Arawa Lakes Trust raised the issue of historic consent for sediment build up removal with Rotorua Lakes Council at the Ōhinemutu Hot Lake. In this case could the sediment be coming from the Utuhina Stream or within the lake?

1. **Sediment movement – some history**

*Historically, sediment deposits have come and gone. At the mouth of the Waitetī Stream this sediment has built up and disappeared since 2003.*

Action 11 – Item 5a – Max Gibbs to scope a project to determine where the sediment source is.

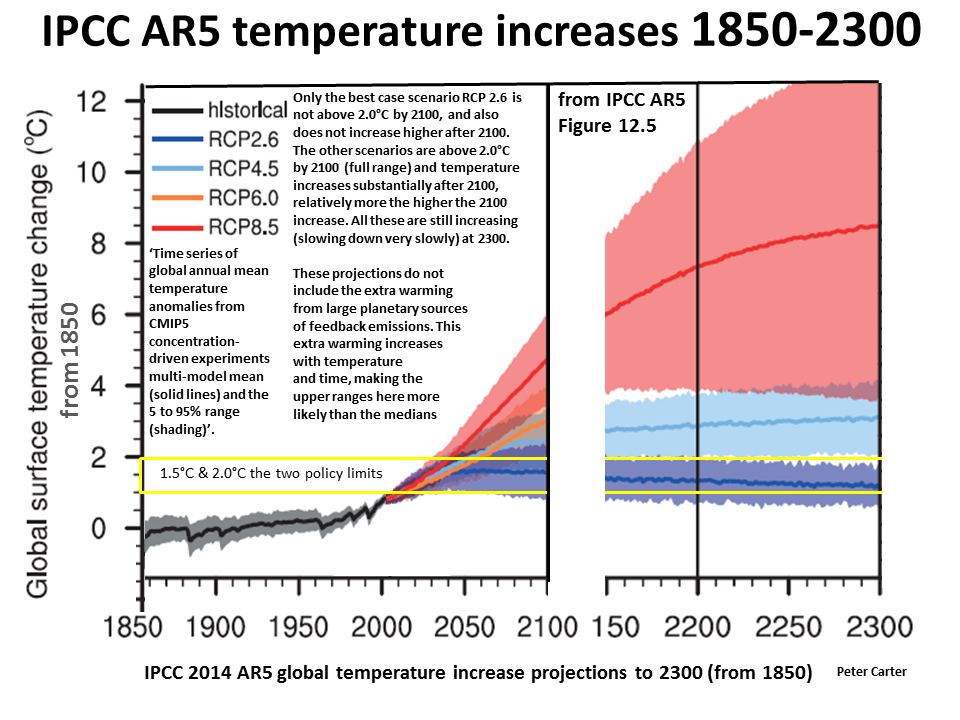
**Action 12 – Item 5a – David Hamilton to distribute Jamie Prior-Thurston and Jonathan Abel sedimentation research paper.**

**Item 7: Climate Change**

1. **The impact of projected climate change on lake restoration - David Hamilton/ Piet Verburg**

*There is a feeling that the council and community are receptive to the message of climate change and we may be able to get some traction with a statement released on it. Discussion covered the following points as consequences of climate change from the paper circulated:*

* More frequent high rainfall events
* Increased erosion brings more nutrients and sediment into the lakes
* Changes to water level
* Higher ambient temperatures, increasing potential for longer duration of stratification, sediment nutrient releases and algal growth
* Changes in the rate of biochemical reactions (related to increased water temperature)
* Habitat change due to differentiation in lake levels – cyanobacteria and macrophyte growth will increase.
* Chapter discussed – Effects of Climate Change on NZ Lakes
* These papers compare annual data from 40 lakes around the world
* Main points within the paper are that the stability of the atmospheric boundary layer is correlated to latitude. Complex issue where exchanges of heat between surfaces of lakes and the atmosphere increases towards the tropics. It has an impact on the warming and cooling of the surface influencing the stratification within the lakes.
* Based on the data calculated a scenario that in Lake Taupō evaporation will go up 30% whilst rainfall may only increase by 5%.
* There will be greater variability of lake levels.
* Susie Woods’ research indicates increase in cyanobacteria and toxin production. *Microcystis,* in particular, likes warm conditions.
* Lake temperatures in Northland may be the sort of temperatures that we can expect for the Rotorua Lakes in the next 40-50 years. Lake temperatures could then be 2-3 degrees warmer than currently.
* By 2190 ambient temperatures are predicted to change by 10-15 degrees (to back this up, going on current trajectories see *Figure 1*. below).



*Figure 1. Current trajectories for Global surface temperature change from IPCC AR5 (Peter Carter)*

* Heat fluxes also affect evaporation and also increase with climate warming
* Identified document “Climate Change Adaptation Guidelines 2016”
* Document recognises the need for authorities to prepare and plan mitigation action in order to address what will happen in the next 40-50 years. There are already lakes in the Rotorua area which have major issues. How will these lakes cope in the future with climate change?
* Important to undertake scenario planning and imbed TLI into our scenario planning.
* The action points within this document need to be addressed now.
* How many leaders within the regional councils and councillors are putting plans in place to prepare for climate change?
* Suggestion of developing an in depth paper looking at eutrophication, water level implications etc. in the area that may occur due to climate change.
* Issues identified recently that may be the beginnings of climate change in the Rotorua Lakes:
* Rotorua sewage treatment plant double the maximum flows they’ve seen in previous years during April this year. Traditionally had peak flows of 42ML/day, in April this year there were 3 instances of flows being around 72ML/day.
* Lake Ōkāreka has had highest lake levels this year since 1963. It is now at a point where the levels are reducing so quickly the opposite may happen.
* Impression that councillors recent workshops on climate change covered more large flood events and sea level rising rather than lake issues mentioned today.
* Decisions around climate change need to be made at policy and top tier levels including councillors. What are the issues that we may face with the Lake Programme? How can the Water Quality TAG ensure that the potential risks of climate change are taken on board by the councillors and mitigation plans can be put into place? What is the best forum to provide this information?
* Identified the necessity of an in depth paper and a statement produced to go to council.

Action 13 – Item 7a – David Hamilton to prepare draft paper and identify 6 points which can be taken to the councillors. To be circulated by email to the WQTAG for discussion.

Action 14 – Item 7a – Andy Bruere to Invite Michelle Lee to the next WQTAG meeting to discuss climate change mitigations.

**Item 8: Sewage update – Standing item**

1. **Rotorua and Rotomā/Rotoiti sewage programmes**

*Alison Lowes’* [*PowerPoint presentation*](http://www.rotorualakes.co.nz/vdb/document/1615) *to be circulated to the TAG.*

1. **Tarawera sewage steering work: Not discussed.**

**Item 9: In-lake N reduction study**

1. **Review of In-Lake actions to achieve 50 t. Draft report to be circulated *(***[***Evaluation of options for nutrient reduction in Rotorua - Jo McQueen, Wildlands***](http://www.rotorualakes.co.nz/vdb/document/1616)***)***

* The above report is a review of information that is already present.
* Some of these changes come from PC10, incentives, gorse conversions, or engineering and other options.
* Some ideas were rejected either because they were undeveloped technologies or impractical.
* Discussion around the use of the term rejected. More clarity requested on why some methods have been ‘rejected’. Better term suggested of ‘currently not recommended’.
* Assessment was based on the likelihood of effectiveness, cost, and benefits.
* Discussion over suggested nutrient reduction options:
* Identified that all existing wetlands should be protected, expand where possible any existing wetlands and create new wetlands.
* The enforcement around current wetlands is not strong enough at present.
* Te Arawa Lakes Trust expressed interested in supporting any wetland enhancement projects that support nitrogen reduction targets.
* De-nitrification walls (specific areas in the catchment)
* Wetland creation was attempted approximately 10 years ago along with an assessment of de-nitrification walls. It was suggested that denitrification walls were not a feasible option due to their permeability around the edges. To be effective water needs to go through them.
* Watercress beds were considered but did not fall into the recommended actions for council.
* Would be more effective in conjunction with wetlands. Studies completed were small scale. Issues around other contaminants, such as Arsenic, that may impact the likelihood of watercress beds being an option. This option is also dependent on there being suitable land for this to work.
* Discussed N farming and aligning incentives board with watercress beds if individual farmers wished to undertake this technique.
* Questions raised around the cost of these options versus buying land back.

*General discussion:*

* Concerns brought up around the gorse project where large areas of gorse are cleared to expose the land to high sedimentation and P loss.
* Questions raised around nitrogen fixing plants such as gorse and broom. Why do they produce such an excess of nitrogen that it leaches into the soil. It was questioned if plants fix additional nitrogen that leaches into the soil.
* Explained the integrated framework – rules around N removal from the Rotorua catchment
* Concerns brought up that P is not being aligned with the integrated framework management plan. P needs to be taken into account in this framework. Each of these management options need to have comments around how these figures align with P removal.
* Changes around PC10 identified that we needed to align phosphorus management with nitrogen management. P should then be taken into account in the integrated framework. Discussion around amending current statement to bring P into the program.

**Action 15 – Item 9a – Alastair MacCormick to distribute report (Evaluation of options for nutrient reduction in Rotorua - Jo McQueen, Wildlands) for comment. Look at bringing in alignment with P. Put a table of the evaluation in the introduction (shift all of the rejected options into an appendix).**

**Item 10: Tarawera conceptual plan**

*Explanation and discussion of* [*conceptual model diagram*](http://www.rotorualakes.co.nz/vdb/document/1609)*:*

* Created diagram to be able to show the flow/ linkage between lakes
* Discussion around the model
* Important to look at proportion of water that moves through ground water vs. surface water – It is a fair assumption that water is not denitrified in ground water
* Suggestion of getting a summer student to assist Alastair with this project
* Two things to look into Nicki’s interest in leading a group to ensure engagement with the right people also NPS process to go into.
* Hypothesis proposed that Lake Tarawera may have another (geological) source of oxygen that stops it from going anoxic when stratified.
* Lake Tarawera is monitored in response to complaint for cyanobacteria.

Action 16 – Item 10 - Alastair MacCormick to distribute Tarawera conceptual plan excel model.

Action 17 – Item 10 – Alastair MacCormick to talk to Troy regarding assistance from summer student for the Tarawera conceptual plan project.

**Item 11: Other business**

1. **Ohau Wall update corrosion and fish pass**

* Regular monitoring is in place including continuous monitoring of king piles
* It is expected that the wall will last the 50 year life span.
* Three fish passes have been installed on request from the community. One hole that was in the wall has also been left as a fish pass.

1. **Update on Plan Change 10 policy for Rotorua**

* Many TAG group members are part of the PC10 science review group.
* Andy Bruere will ensure that everyone gets a brief of the work that is to be done. Part of this is that there needs to be an independent reviewer appointed. Warwick Vincent has been suggested to fill this position.
* Warwick Vincent is a former student of Warwick Silvester. Warwick Vincent has worked on a number of the lakes and has a good publication record on them. Decision made to appoint Warwick Vincent as an independent reviewer.

1. **Alastair McCormack discuss OVERSEER new business model - Postponed to next meeting**
2. [**Lake Ōkāreka Lake level**](http://www.rotorualakes.co.nz/vdb/document/1610)

* The output pipe flow has been turned down as reduction in lake level is higher than expected. This pre-emptive measure is to ensure that the lake level does not go to the other extreme with a warm summer.

1. **Introduction of Troy Baisden as chair**

* General direction will be to take more of a whole catchment focus rather than just directly at the lakes. There is also the potential to extend into the coastal zone of the region.
* How will this be implicated?
* Ensure that PC10 gets across the line
* Science to focus more on decisions that need to be made and engaging with people making those decisions instead of abstract topics.
* Keep in mind the notion of the next plan change, potentially will be looking at interconnected lakes and catchments. This is an area of interest for Te Arawa Lakes Trust and will be important to manage community engagement. Simon Stewart is researching food web interrelations with isotope tracing that may be a useful opportunity to involve the community in understanding lake systems.
* Potential to approach issues using isotope and remote sensing technology.
* Do we have plans of what to do in the course of major volcanic eruptions? Create a risk framework for this.
* Questions raised around where Lake Modelling fits in

**Item 12: Other Matters**

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| --- | --- | --- |
| White: Undertake simple GW work to establish GW catchment boundaries for Rotomā. | **On Hold** | Not commissioned yet, monitoring started McIntosh |
| Bruere: Recommend development of methodology for establishing P loads from land use. Take to Land TAG and talk to Sandy Elliott | **On Hold** | Andy refer to new Land TAG Workshop in November 2016. |
| Repeat the NIWA monitoring work around septic tanks at Ōkāreka and install a shallow water bore at Steep Street for ongoing monitoring. | Paul has undertaken one round of peizo monitoring. | Paul Scholes progressing |

* Lake WQ Society Symposium discussed the control of weed in all of Lake Rotoiti in relation to the depleted oxygen rates associated with macrophyte growth. Since the Ōhau Channel wall was constructed oxygen depletion has reduced in Lake Rotoiti. Question brought forward as to whether the wall is no longer needed full time and the potential for a gate to be constructed in the channel wall to allow oxygenated water to flow to Rotoiti at times of the year. This could also potentially ease some angst around consenting issues.
* Is there a need for potential modelling of Lake Rotoiti? What will happen in the long term if the wall is taken out? In the short term, for example March through to September; a gate could be used to let the water out of the lake, increasing oxygenation within the lake through these months. Modelling is proposed after the Tarawera and Ōkaro work is completed.

Action 18 – Item 12 - Andy Bruere to add items to take to the next Sediment TAG Agenda: Lake Ōkaro, Lake Rotorua Sediment report and Lake Rotoehu.

Action 19 – Item 12 – Project for the future: Update the Lake Rotoiti model to include inflows into the lake.

**Action 20 – Item 12 – Andy Bruere and Troy Baisden to discuss options for creating a gate in the Ōhau Channel Wall to aid in aeration of the lake bottom waters at times.**

**Action 21 – Item 12 – Andy Bruere and Jo Butterworth to discuss water quality management around Lake Rotomā and other lakes.**

**Item 13: Meeting Finish 4:45pm**