MEMORANDUM

To: Water Quality Technical Advisory Group

From: Andy Bruere
Lakes Manager

Date: 17 August 2011

File Ref:

Subject: **Technical Advisory Group Meeting - 16 August 2011**

A meeting was held with Technical Advisory Group on 16 August. Those in attendance were:

David Hamilton, Paul Scholes, Paul White, Del Raurino, Peter Dine, Rob Lei, Warwick Silvester, Piet Verburg, Chris Palliser, Mark Buckley, Trevor Stuthridge, Max Gibbs, Alison Lowe, John McIntosh and Andy Bruere also Janine Barber during GW discussions by teleconference.

1 Apologies

Kit Rutherford, Clive Howard-Williams and Deniz Özkundakci

2 Matters arising from previous meeting

(a) Tikitapu Action Plan

Paul updated the group on the action plan. The final presentation has been through the Rotorua Te Arawa Lakes Strategy Group and the plan is now on the Bay of Plenty Regional Council's website. Paul mentioned that most of the goals had been met by sewerage reticulation which has been incorporated into the Ōkāreka scheme. He also mentioned there were some other issues with recreation and storm water.

David Hamilton presented on monitoring of Lake Tikitapu and made the comment that it is possibly on the threshold of changing significantly and it had changed remarkably in a number of aspects over the last five years or so. These include:

- Lake SPI has been a significant decline since the 1990s according to work by Tracy Edwards and John Clayton. Most of this decline has been due to loss of native charophyte beds rather than establishment of exotic species.
- Chlorophyll *a* changes had occurred. David showed in graphs that for brief periods during summer maximum chlorophyll concentrations through the water column were close to the surface. This lake has had a stable deep chlorophyll maximum (DCM) and changes in the position of phytoplankton closer to the surface were an indication that the stable DCM may be changing.
- Water quality monitoring had shown an increase phosphorus and ammonium fluctuations recently.

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- Sediment core work undertaken by Chris Hendy had shown changes in the depth to the Tarawera tephra at different core locations. It appears that the organic sediment layer that normally that normally overlies the tephra (c. 4-5 cm) has been lost in some parts of the lake while in others it is several times thicker (up to 20 cm). This appears to have occurred since Dennis Trolle did his study in 2006. The risk is now that silica concentrations will increase in the lake water where the exposed tephra leaches silica to the overlying water at much higher rates than the undisturbed sediment. David commented that Lake Tikitapu normally has very low silica concentrations in the water column which severely restricts diatom growth and this contributes to the 'blue' colour of the lake water. A current Masters study by Marie Dennis (based at Scion) is finding greater numbers of diatoms than in the past.

There was some discussion around the possibility of currents being set up by the annual ski race and a need to identify when this event started and when it takes place each year.

The presence of higher silica concentrations potentially could allow greater levels of diatoms to grow and change the lake's trophic state negatively. There was some comment around Lake Ngahewa which linked increases in silica concentration since McColl's 1972 finding of very low levels, to transition into a eutrophic state.

Action:

The Bay of Plenty Regional Council and RDC staff to work together to attempt to measure storm water inflows particularly around the road and reserve areas and quantify potential magnitude of nutrient inputs at this point.

Action:

Andy to identify when the boating events occur on the lake and liaise with University of Waikato and NIWA to get current measuring equipment in place if it is decided appropriate.

(b) Rotoiti control gates

David presented on the modelling work which Kohji Muraoka had been undertaking for the university. David summarised briefly the outcome of this modelling work. This modelling has come about as a result of the resource consent to change the operation of the control gates and concern around the impact of that on the effectiveness of the Ohau diversion wall. David commented that in the main (eastern) basin up to 9% of the water over a four-month period in summer could be tracked back to a Rotorua source. In the western basin it is around 20% and Te Weta and Okawa bays about 16%. He also mentioned that the outflow during November 2010 was less than the inflow for about two weeks and could well have contributed to the algal bloom in Okawa Bay in February 2011.

There was concern from this modelling work that operation of the control gates without due regard for the difference between the Ōhau Channel and Okere flows could result in significant quantities of water coming around the end of the wall.

Peter Dine questioned whether the operating rules would restrict this and mentioned the obvious solution would be to ensure that the flow through the control gate is always greater than the flow coming down Ōhau Channel.

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David also mentioned that when Rotoiti is stratified the water coming through from Rotorua seems to be inserted at an intermediate depth (the thermocline) for extended periods in summer and not necessarily extending into Rotoiti as a buoyant plume which would be more likely to flow out the Okere Gates.

Action

Andy and David to present the outcome of this modelling to Bay of Plenty Regional Council engineers so that these results can be taken into consideration through the operation and possibly the current resource consent application in front of the Environment Court.

(c) Lake Tarawera drilling

Paul White and Janine Barber updated the group on groundwater investigations for the wider Tarawera catchment. Paul presented the information of G. Zemansky. The notes are attached. This provides better groundwater information for the Buried Village area and the Rotomahana and Rerewhakaaitu areas.

Janine then provided information on the groundwater monitoring proposal for around Rotorua, Ōkataina divide, Ōkāreka, Rotokakahi and south west of Rotokakahi.

[Additional notes from Janine B:

Here is an overview of where we are at with Phase II of the Tarawera drilling program.

See map attached for locations, (Appendix 2) shows location of existing bores under the lakes drilling program.

Site 4 Buried village (Rotokakahi-Tarawera) monitoring bore is completed, aquifer testing is completed and water samples taken. Water quality results are received an d show good water quality. Still awaiting isotope dating results.

Site 5 Rerewhakaaitu will have two monitoring bores installed. One into the shallow aquifer (19m) and another in the deeper aquifer (80-100 m). Presently awaiting pipe and screens to complete construction of these bores. Preliminary aquifer testing and water samples have been taken. Low flow rates and poor water quality (iron) for both bores. A full aquifer testing regime and sampling round will occur once the bores are constructed. Bores to be completed week 29 August, testing to follow.

Site 6 Rerewhakaaitu bore drilled to 50 m. Are presently awaiting pipe and screens to complete construction of this bore. Preliminary aquifer testing and water samples have been taken. Poor water quality (iron). A full aquifer testing regime and sampling round will occur once the bore is constructed. Bore to be completed week 29 August, testing to follow.

Site 7 Rerewhakaaitu bore drilled to 60m, but no water flow present. Propose to drill to 100m to intercept groundwater. The site is presently too wet to support the rig (rig sinks and gets stuck in Rotomahana mud). Need to wait until site dries out. Possibly in four weeks' time the rig can return to complete the drilling. Then the pipe and screen will be ordered to construct the bore. Once constructed aquifer testing and water sampling will be undertaken to complete the investigation program.

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GNS are presently working on the report for this project. I have asked them to wait until all the information is in (site 7) before the report is sent into us for review.

Tarawera phase III drilling program is shown within the blue boundary on the map (1). The initial focus for this area will be Rotokakahi.

Tarawera phase IV is in orange (2) and phase V in green (3).]

Paul Scholes also raised the issue of the need to get groundwater information for Lake Rotokakahi. This was left for later in the meeting.

Action

Janine Barber to provide notes and a map of future groundwater priorities with Paul White. (Attached now) This is to be circulated to TAG group for comment and planning of groundwater programme for the Ten Year Plan.

(d) Rotoehu monitoring buoy

David provided an update on information from the recently installed monitoring buoy. The buoy was deployed in April 2011. Some main comments from that were:

- Temperature information indicated that there was still some winter stratification.
- There was variation between top and bottom water dissolved oxygen which was linked to the stratification periods identified.
- Chlorophyll and phycocyanin indicates that 'blooms' in the lake were identified until mid-June 2011.

David also presented information on the Rotoehu models. One-dimensional (1D) and three-dimensional (3D) models of the lake have been set up. These reproduce the data well and have been well validated with the limited time period when high-frequency data are available from the lake buoy.

(e) De-stratification model work

David presented the latest the information of the de-stratification model which is being used to assess the validity of applying de-stratification to Lake Rotoehu in the near future. We have been working with Hans Burggraaf on a design which included a three metre diameter tube pumping about 14,000 cubic metres per hour of water from the bottom to a spreader nearer the surface. Variations of this design have been tested with the models.

His comments were that the results for a single diffuser or machine were disappointing and were having a limited impact on lake mixing and de-stratification. The 1D model indicates very large amounts of air are required to get towards the required levels of de-stratification.

He also undertook some modelling work testing oxygen saturation due to the air flow up the diffuser. However he commented that this outcome was an unrealistic estimate because there was not enough time for the water to absorb the oxygen and become saturated with oxygen in the three seconds contact time as it travelled up the tube.

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He then presented information on running three diffusers in the 3D model for a one month period. This still resulted in the failure to break stratification and there was difficulty in providing a great deal of horizontal coverage to fully mix the water column. He commented that investigation of success of these machines overseas seem to be more related to canyon-shaped reservoirs and it was more difficult to operate in a shallow lake. It was also commented that sometimes the purpose was to mix or de-stratify near a barrage wall or an outlet from a lake/reservoir and the water quality further upstream was not always reported on.

Action

Work with Hans Burggraaf to attempt to resolve these issues with machine designs.

The group offered some other solutions in the discussion such as:

- Possible collar part way up the diffuser to prevent dense water dropping directly back down and provide some momentum for the water discharged to travel sideways at a greater distance.
- Communication with other people who have experience in this area such as Ken Ashley in Canada.
- Possible outward jet to get motion of particular direction.
- Possible venturi type system which would bring water in from part way up the tube to change the temperature and density differential.

3 Sediment TAG (STAG) update

(a) Terms of reference

Andy presented the final terms of reference and commented that the group had made comments over a period of time. Some more recent comments made regarding explicitly identifying ecological and health effects had been considered but not included in the wording because it is expected that the scope of a STAG's work will "provide advice on relevant methods of lake bed sediment flux management" does indicate that ecological and health effects have to been taken regard to.

(b) Rotoehu project progress

Andy reported that BOPRC is close to obtaining resource consent for the de-stratification project. We have an agreement with the landowners of the Tautara Matawhaura Māori Land Trust to locate compressor machinery on the farm. The project is now reliant on resolving some of the issues raised by modelling with the aim of implementing this year if possible.

David presented on the modelling work in the previous item.

(c) Andy and John presented the Ōkaro and Rotoiti sediment capping work. The need for further sediment capping on Okaro has been identified due to algal bloom in the spring of 2010 and more recently high TLI values returning. So resource consent is being sought to allow for dosing of Aqual-P and alum in future years at Lake Ōkaro as a maintenance dose.

In addition Aqual-P dosing on Okawa Bay of Rotoiti resulted in resolving the algal bloom issue in February 2011 and so it has been identified as pertinent to obtain resource consent for this activity in the future. Some residents also suggested getting resource consent for Te Weta Bay in Rotoiti.

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John provided a presentation testing of efficiency and performance various alum dosing options prior to undertaking any dosing. PowerPoint on the matter was presented. The engineer involved in these investigations is Peter Browne and primary purpose of this work was to test the efficacy of alum at absorbing water phosphorus with a secondary objective of looking at whether there is any residual p-locking capacity for capping sediments. Stage one was to look at the various options for buffering alum to ensure that pH does not go out of that appropriate range. The stage two test may be undertaken looking at performance down a five metre water column if necessary. A number of comments were made around the practicality of doing this work and it was suggested that we identify application methodologies from overseas and maybe avoid cost in this investigation. It was however it was pointed that overseas the general application technique is to apply alum and sodium aluminate. In New Zealand sodium aluminate is not available unless it is specifically imported and so the cost structure around using that and other buffer solutions is quite different to the situation in the United States. The issue of scale was raised in undertaking jar tests cf whole lake. That would have to be considered in drawing conclusions. If phosphorus was added to Lake Rotorua water it should be to a realistic value.

4 Update on action plans and science required

Andy presented a hand out from planners on the action plan process for Tarawera, Ōkataina, and Rotokakahi. It outlined a timeframe for each step in the action plan and the aim for this to be completed within 12 months. Attached as Appendix 3.

John has prepared draft nutrient budgets for each of the lakes. He also mentioned that the nutrient reduction targets were feasible as there were some actions that could be undertaken on each of the lakes and lake catchments to improve lake water quality e.g. he mentioned on Lake Rotokakahi nitrate from the farming areas was high (2-3 ppm) and so catchment actions can be undertaken to attempt to reduce that. For Tarawera there are also some possible actions around sewage reticulation and other options. The actions might reduce nutrient loads sufficiently to meet the target TLI for each lake.

The TAG questioned him around how the nutrient budget had been developed and he explained it has been based on water budget information and land use. This information was then compared with in-lake monitoring to ensure that there was some consistency.

Paul White also mentioned the work Nicholas Gillon had undertaken in this area and suggested that it could be a useful resource to assist.

John mentioned that there was now a process to audit these budgets being run by planners. Andy also mentioned that David was undertaking some lake modelling work in parallel with this to give another estimate of nutrient budgets. It was pointed that this modelling work needs to be completed in the near future to ensure it is included in the action plan process.

Action

Andy to see Tony Briggs the planner leading this work to ensure that communication between David and BOPRC planners and discuss possible audit process.

Paul White asked if the Regional Council wants him to consider possible groundwater sites to assist in this project with respect to wider groundwater information.

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5 Floating wetland

Andy updated the group on the floating wetland work and explained the strong interest from community groups for these floating wetlands in particular iwi groups. He mentioned that they had been identified as a potential habitat for native organisms particular koura and also that there was interest from iwi groups around planting different useful plant species in them. The objective of discussing this matter is to highlight the request from the community particular the iwi group for further research around floating wetlands and whether there was opportunity link with people from own community to assist with this research.

The group suggested research around a couple of plant species may be of interest including raupo and a possible food source and some parts of the plant have value in product such as insulation and fibre production. Also kuta (*Eleocharis sphacelata*, paopao) was mentioned as a possible weaving material for tukutuku panels.

Warwick Silvester suggested that to enhance the performance of wetlands for nitrogen removal we would need to harvest them. John explained that in the trial work that we had done, part of the nutrient removal had been due to plant uptake but we are continuing our wetland trials so that we can get better information on the proportion of N uptake and de-nitrification over a longer period of time.

Andy also mentioned the progress on the engagement projects with Ngāti Rangiwewehi. This included the koaro project that Matt Bloxham is leading for possible restoration of koaro and three habitats around the Rotorua lakes. The restoration of the Awahou Stream with riparian works and possible regeneration of watercress in the lower reaches with the use of floating wetlands and also their request to engage with the university and potential researches and students there. The area of interest with the university included global warming issues, storm water and phosphorus monitoring work and they suggested a field visit with some staff and students from the university to look at possible research projects around the Hamurana and Awahou Streams.

Action

Andy to work with David to investigate potential research projects in the areas above. Include appropriate people such as Ian Kusabs to assist in identification of projects.

6 TAG terms of reference

Andy presented the proposed TAG terms of reference. He noted that he could not find any terms of reference for the group and that it was important to ensure that a group such as this has an identified terms of reference. This is of particular importance when presenting information to council and other groups from the TAG as well as in the situation of applying for significant funding for our programme.

Action

Andy to circulate the terms of reference electronically to the group. Over the next month the group to feedback comments on the terms of reference for refinement.

Andy explained the terms of reference will need to be taken back to Rotorua Te Arawa Lakes Strategy Group for their approval before adopting.

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7 Rotorua sewage update

Alison Lowe provided a very detailed update on the Rotorua sewage disposal system in the Whakarewarewa forest. She explained currently the treatment is the Bardenpho activated sludge process. However an upgrade is occurring where one-third of the sewage flow will flow through a MBR system. She also explained that they were dosing about 1500 litres of ethanol per day for nitrogen removal prior to irrigation into the forest, as a carbon source for N removal.

Between 1991-2003 the irrigation system was operated on two blocks per day with six blocks resting. With this regime they found nutrient leaching was high and changed to a new operation regime since 2005 where all sites get 2-3 hours of irrigation per day at about 5 mm per hour.

The following gives the summary of the nutrient from sewage in Rotorua city:

- 300 tonnes of nitrogen and 40 tonnes of phosphorus come to the sewage treatment plant from the community annually.
- 62 tonnes of nitrogen and 21 tonnes of phosphorus are applied to the forest after treatment in the Bardenpho plant.
- 43 tonnes of nitrogen and 2.7 tonnes of phosphorus reach the lake from irrigation system each year.
- Resource consent requires that nutrient inputs to the lake from the forest system should be less that 30 tonnes of nitrogen and three tonnes of phosphorus.
- The application area is 192 ha and an operational site of 360 ha (that's allowing for buffer zones, roads etc).

Alison explained that de-nitrification that was expected in the wetlands has not resulted in the performance initially predicted. There appears to be a number of reasons why this is happening including possible bypass flows through the wetlands as time has passed.

There is difficulty in getting the Waipa load to less than 30 tonnes of nitrogen. The MBR is an $8m upgrade which will be operational from 2011 onwards.

By 2051 with this upgrade there will be 45 tonnes of nitrogen going to land disposal. She commented that the upgrade may not result in any higher nitrogen removal levels in the land treatment system.

Discussion focussed on whether there were any further options to enhance the removal of nitrogen from the land treatment system. These included:

- Constructed or amendments to wetland areas to enhance nitrogen removal.
- Investigation into irrigating a larger area
- Allow the residual nitrogen within the land treatment system to leach out and then apply effluent with lower nitrogen concentrations (higher level of treatment).

It was also acknowledged that there appears to be an issue of complete soil saturation creating anaerobic conditions which are not conducive good nutrient removal processes (as the applied effluent is already strongly denitrified).

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8 Rotomā sewage update from Mark Buckley

The Rotomā sewage treatment plant is the only other sewage treatment plant within the lakes area not feeding to the centralised Rotorua system. Mark explained that this plant will receive wastewater from the eastern end of Lake Rotoiti and most of the Rotomā catchment. Andy also explained that during the action plan process sewage reticulation of Lake Rotomā had been identified as the key action to reduce Rotomā nutrient inputs to a sustainable level.

Mark identified the following points:

- He discussed the range of sites which were investigated in arriving at the decision to use the site about 500m north of Lake Rotomā
- He then discussed the details of the site, location of monitoring bores, surface contour and water flow issues
- He explained that the valleys on the site head north and that the surface layers of the soil profile were relatively impermeable and created erosion and runoff problems on the site. However layers deeper than one metre were highly permeable.

The design of the site is to remove the low permeability soil layers and create disposal trenches to get infiltration of wastewater into deeper soil layers.

The treatment plant is to be an MBR plant where it will achieve about 90% nitrogen reduction from the incoming effluent.

The design has taken into account population and flow predictions up to 2046. Staged increases in treatment disposal capacity will be implemented as these increases occur.

There was some discussion around the contingency if flow predictions were exceeded and also around impact on the nearest watercourse. Mark explained that from their experience their flow predictions so far for other communities has been conservative and they saw no reason why this would be different and explained the closest watercourse was around 10 km north into some springs into the Waitahanui Stream.

Paul White has been engaged as the groundwater consultant on this proposal and was addressing issues such as determining whether flow would get back to Lake Rotomā and clarifying the certainty of flow direction. Paul explained that in this location the flow direction of groundwater was not obvious and that he was undertaking work to get some certainty around that. He was also providing for the district council some remediation options as well as the monitoring programme to ensure the impact would be monitoring satisfactorily. There was a question about the irrigation rate and explained that it would be 50 mm per day and they would like the flexibility to be able to adjust this as they gain experience with the best method of operation. He explained that the disposal would be into the permeable deeper layers of the soil on an area of about 2.8 ha. He explained that full irrigation on the site was not feasible due to irrigation issues but they may look at irrigation to supplement land operations for a small portion of the effluent into the future.

9 Lake Rotokakahi update

(a) David provided an update of water quality issues of Lake Rotokakahi as a result of recent algal blooms and fish kill problems. He explained the investigations provided no evidence to link the fish kill to a low DO event. Wind appeared to pushing the algal bloom on the lake up towards the outlet and he showed a video taken by Joe Butterworth of significant algal bloom down the Te Wairoa Stream. He also showed

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some photographs of the forest harvesting which occurred in 2007 and identified the concern of water and sediment running off these harvesting areas into the lake at that time. There are some concerns that this may have contributed to the current problems with Lake Rotokakahi.

(b) David then showed some graphics of phosphorus levels in the Te Wairoa Stream and the oxygen trend for Lake Rotokakahi since 1990. He commented that the lake bottom water had become progressively deoxygenated and became fully de-oxygenated for periods since about 1995 and this obviously is likely to have an impact on nutrient cycling.

(c) It was raised that due to this significant and rapid decline in water quality for Rotokakahi since about 2007 there needed to be a closer investigation as to what might be causing this problem. Andy raised the issue that the community will want to know whether than land treatment system could be contributing to this and that it would be pertinent to make a proactive approach to investigating this.

Action

Paul White to meet with John McIntosh, Alison Lowe and Janine Barber to develop a process for discussion and review of information on groundwater flows and land treatment system.

Action:

David Hamilton to review lake water chemistry to assist with the action above.

(d) Radon monitoring

David presented some information on radon monitoring undertaken by Isaac Santos from the University of Sydney. This work showed radon monitoring in Lakes Tikitapu and Rotokakahi which Issac undertook when he was in New Zealand recently. This information provided some radioactive measurements of radon but David explained this could be calibrated to determine possible groundwater flows coming into through various locations. David explained this could be very useful for water budget application for any of our lakes and in particular identify the magnitude of various groundwater inflows where it is not possible to measure them otherwise.

Action

David to check out cost and further details of this methodology for next TAG meeting. It was also suggested that he identifies priority lakes for that meeting.

10 Rotan and lake model updates

David presented the information to the TAG on the Rotan and lake model work which has been completed recently. This has been presented to about three different seminars and many of the TAG had already seen this but was an opportunity to ensure that the information is available to all TAG members. Some interesting points that came out of this were:

- With climate change there is predicted to be some extreme changes in weather events. David showed one event which indicated the 212 mm rainfall event was currently a 50 year return period and in future was likely to become by 2100 a 25 year return period therefore doubling the frequency of these extreme types of events.

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- The lake model required some estimates of nutrient releases from bottom sediments as trophic state of the lake has changed. David indicated that this was a significant challenge to the project as it is difficult to determine what happens to the lakebed nutrient releases as we change water quality. However, recent sediment work that looked at the historical composition of the sediments and linked sediment concentrations to the ROTAN-predicted N load, have enabled a reasonable predictive model to be used to predict future N releases under different catchment N-loading strategies.
- He pointed that at 350 tonnes reduction in nitrogen coming from the catchment would provide a significant improvement in oxygen levels in lake bottom waters.
- There was some discussion around sediment capping benefits. The modelling showed only a marginal benefit for a period of about four years. It was discussed that it may be applicable to undertake multiple capping applications and perhaps that should be tested in the modelling situation if possible. There was also mention that if the capping occurs in 2031 when the load has been reduced then it is likely to be less effective than being applied in 2015 before the nutrient load from the catchment has been reduced.

Some of these options will be tested again in the model if possible.

11 Tikitapu sediment work from Chris Hendy

David presented on this matter under item 2.

12 Update on other projects being implemented

Andy mentioned the projects of interest that had been completed recently. These include:

- The soda springs phosphorus locking plant alum is now dosed into the Waitangi Stream flowing to Lake Rotoehu. John is undertaking monitoring around this to check performance but is expected that we can get around 700 kg of phosphorus from that stream. This is the total phosphorus target for the lake and is aimed at operating at 10-15 years to produce a nutrient reduction in advance land use changes taking effect.
- The Tikitere de-nitrification plant. The design of the plant had created some pH imbalance problems and so the operation of plant so far has focussed on ironing out teething problems with operational control. In particular pH swings have been killing bacteria in the aeration part of the plant. This has now been resolved by changing the design of pH control tank. This tank is now an off-line tank where a high pH slurry is used to dose into the incoming acidic flow and keep the pH between 7.5 and 7.8. It is expected now that the bacterial side of the plant will operate efficiently and in the near future will have results for performance of the pilot plant at N removal. The aim of this plant is to provide performance information for the design of a full scale plant.

13 Other business

Paul Scholes presented information on progress achieved at Lake Rotoehu in terms of nutrient reductions. It was pleasing that the TLI for Rotoehu is now at 4.14 down from 4.5 last year and this is associated with significant reductions. These include the following:

- Nitrogen reduced from 326 to 267 mg/m^3.

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- Phosphorus reduced from 51 to 30 mg/m^3. He also presented information on cyanobacteria blooms over the last 3-4 years and there appeared to be a significant reduction in cyanobacteria over the last three years.

It was discussed the actions that are likely to be contributing significantly to this and the main action is weed harvesting where for the last three years over 3000 tonnes of weed have been taken away from the lake contributing reductions of around about 4-5 tonnes of nitrogen and 300-400 tonnes of phosphorus. This is more than half the lake reduction target specified in the action plan.

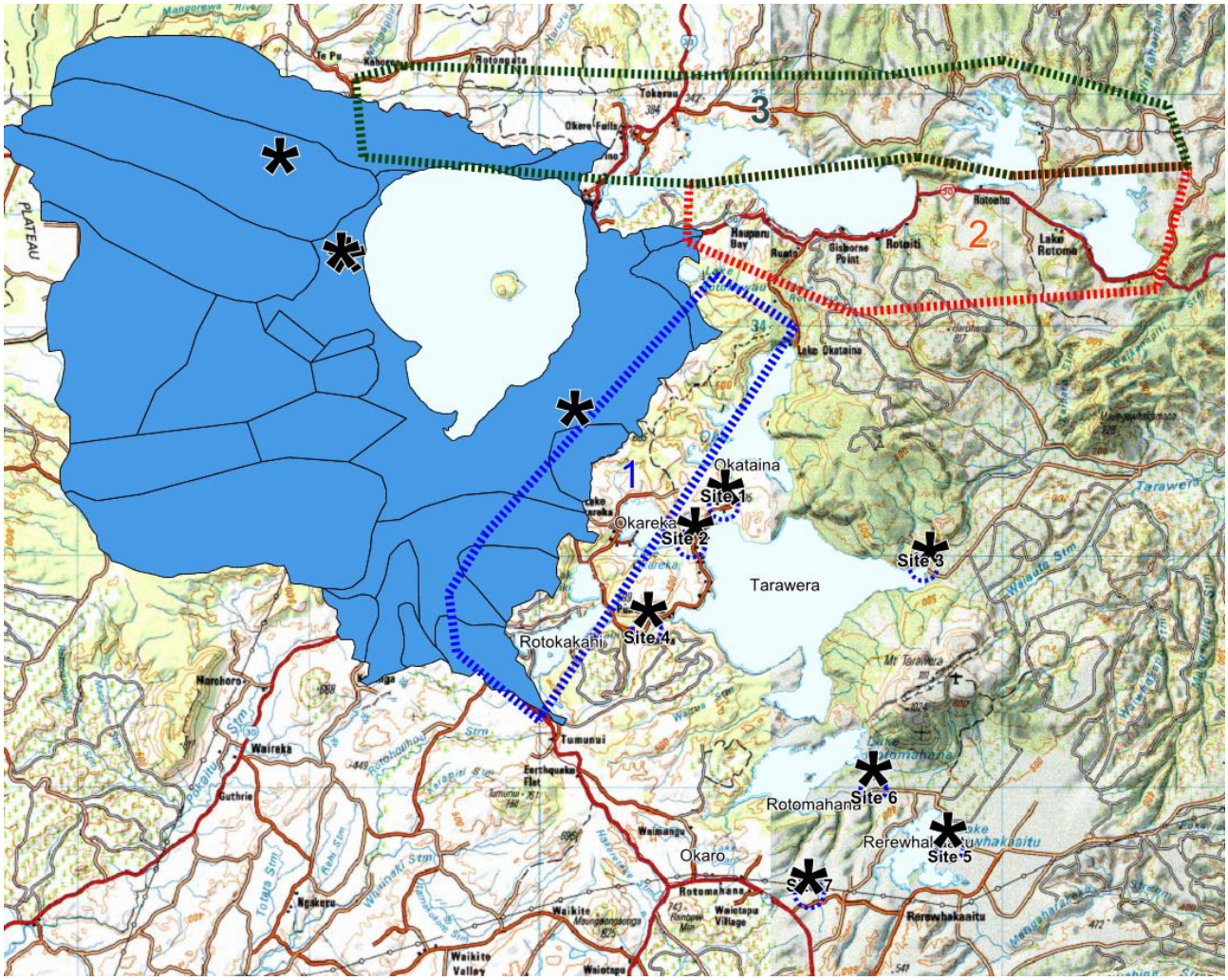
Appendix 1: Zemansky Notes on Tarawera drilling

Tarawera drilling update

Phase 2 of the Tarawera exploratory drilling project is currently underway. Work consists of the drilling of a temporary observation well and a permanent monitoring well at each of four sites. The permanent monitoring well is intended to double as a water supply well for the landowner involved where yield and water quality allow. The sites are located at: (1) the Buried Village (between Lakes Rotokakahi and Tarawera); on farmland near Lake Rotomahana (between that lake and Lake Rerewhakaaitu); and on the (3) northeast; and (4) southwest sides of Lake Rerewhakaaitu. The target depth for all wells at all sites is 60 m; however, depths may be greater or lesser depending on geologic/hydrogeologic conditions encountered. To the extent indicated by the geology/hydrogeology encountered and made possible by drilling conditions, vertical delineation of aquifer properties and groundwater quality is attempted during drilling operations. After the permanent well is installed at each site, a 24 hour constant flow rate pump test is conducted at the end of which a water sample is taken. Where pump test conditions are marginal, slug testing may be done to determine aquifer properties. Drilling has been completed at the Buried Village and the site between Lakes Rotomahana and Rerewhakaaitu. Drilling at the Buried Village stopped at a depth of 30 m in rhyolite and the permanent well there will be used to supply water to that facility. Drilling at the two sites near Lake Rerewhakaaitu is continuing with the target depth increased to 100 m at each in an effort to obtain additional delineation of geology and better quality water.

G. Zemansky
GNS Science

Appendix 2


Okataina
Site 1
Okareka
Site 2
Site 3
Tarawera
Rotokakahi
Site 4
Rotomahana
Site 6
Site 5
Okaro
Site 7
1
2
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Appendix 3

FILE NOTE

File Note From: Toni Briggs
Policy Analyst

File Reference: **Date:** 12 August 2011

Subject: **TAG Group update on Lakes Tarawera, Ōkataina and Rotokakahi Action Plans**

Overview:

Three Action Plans are currently being drafted by staff within the Sustainable Development Team:

Lake Tarawera - Karen Parcell, Senior Policy Analyst

Lake Ōkataina – Michelle Lee, Planner

Lake Rotokakahi – Toni Briggs, Policy Analyst

- Each of the Action Plan projects has a 12 month turn around, with draft Action Plans being published in July 2012.
- Each of the projects has a project plan, engagement plan and timeline available on request
- Many of the deliverables for each of these projects are being done in tandem to facilitate a streamlined approach
- Each lake has had a draft Nutrient Budget developed in the last month
- The next steps for each lake:
    - targeted key stakeholder engagement
    - Further scientific discussion on problems, reasons, further research areas etc

See attached table for an overview of the integrated approach to the Action Plans and key deliverables at each phase of the project.

Three Lakes Project Plan		
Approach	**Key Deliverables**	**Notes**
Phase 1 – Pre Action Plan Main goals for Phase 1 are to: 1. Establish the scientific base (as far as possible) and complete a nutrient budget 2. Produce a background report summarising the issues 3. Commence/continue engagement with the community	**Deliverable Item 1 – Problem Definition/Background Report** A concise public friendly background report summarising the issue and the science. **Date for Completion: June – July 2011 COMPLETED**	Will use a common template/format with minor adjustments according to individual characteristics of the lake
	Deliverable Item 2 – Nutrient Budget This work is currently being carried out by external consultants and the science team. This base information is expected to change over the course of the project but some starting point is necessary. **Date for Completion: June – July 2011 COMPLETED**	Will use a common template/format with minor adjustments according to individual characteristics of the lake
	Deliverable Item 3 – Engagement meeting with key stakeholders and community members Hold a meeting with stakeholders to re-engage and present updated information and approach. **Date for Completion: July – August 2011 COMPLETED**	The bulk of initial engagement has been completed for Lake Tarawera this stage will be a re-engagement process. Rotokakahi and Ōkataina communities/stakeholders have not been contacted so this represents the first contact with these groups
	Deliverable Item 4 – Workshop/meeting Hold a workshop with stakeholders **Date for Completion: November 2011**	Lakes Rotokakahi and Ōkataina only
Phase 2 – Development of Draft Action Plan	**Deliverable Item 5 – Options Analysis** Analyse all viable options to improve water quality and select suitable actions **Date for Completion: November 2011**	Carried out for each individual lake

Main goals for Phase 2 are to: 1. Analyse options using "toolkit" and select appropriate actions 2. Draft Action Plan 3. Run a stakeholders workshop to present Draft Action Plan and discuss options and issues	**Deliverable Item 6 – Draft Action Plan** Draft the Action Plan document and have approved by relevant committees **Date for Completion: November – December 2011**	Will use a common template/format with minor adjustments according to individual characteristics of the lake
	Deliverable Item 7 – Workshop One day intensive workshop with stakeholders to assess draft action plans **Date for Completion: February – March 2012**	The workshop will have three sessions, each session addressing one lake. Stakeholders with an interest in more than one lake can then attend only one day's worth, rather than having to attend two or three
Phase 3 – Notification Main goals for Phase 3 are to: 1. Publicly notify draft Action plan and receive submissions 2. Prepare final Draft Action Plan including community input	**Deliverable Item 8 – Public notification of draft Action Plans** Publicly notify the Draft Action Plan and receive submissions. **Date for Completion: May – April 2012**	To streamline the process and prevent consultation fatigue, some parts of the notification and submissions processes can be done simultaneously and others separately. E.g. same notification date and submission period, separate submissions forms, separate analysis and report, consecutive hearings dates
Phase 4 – Final Action Plan Main goals for Phase 4 are to: 1. Finalise and launch Action Plans	**Deliverable Item 9 – Final draft Action Plans to committees** Approval of final draft Action Plans **Date for Completion: May 2012**	Same agenda but separate reports
	Deliverable Item 10 – Final Action Plans and launch Final Action Plans released and launched **Date for Completion: June 2012**	A Café au Lakes, or other launch event/s