

# **Proceedings**

## ***ROTORUA LAKES 2006***

***Wonderful Lakes – What Value? – Who Pays?***

*6 - 7 March 2006  
Park Heritage Hotel, Rotorua*

Jointly hosted by

LakesWater Quality Society Inc.

and

The Royal Society of New Zealand  
(Rotorua Branch)

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Environment Bay of Plenty Regional Council  
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## Editor's Note

Not all oral presentations were made available as formal written papers, in which case the edited tape transcript has been used in these Proceedings. PowerPoint files were used in most presentations and where possible edited in to the paper. However, not all slides were used and in such case the transcript may refer to slides that are not present. Colour printing has been used only where it significantly enhances the effect or comprehension of an illustration.

Audience questions and presenter's answers have been included, except those after the early presentations, which were not recorded owing to a technical problem. Where material from the tape transcripts of papers appears particularly relevant or explanatory and does not appear in the written paper as supplied, it is inserted in *Italics*. The editor takes full responsibility for this.

A full transcript of the Forum sessions has been supplied, with minimal editing and that only in the interests of clarity.

*Ann Green*

**Disclaimer:** These Proceedings report the formal presentations and open forum sessions of the Symposium, which was designed to encourage open discussion amongst those managing, studying, or with an interest in the Rotorua lakes. The information is **not** intended to substitute for official policy statements from parent organisations.

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## Foreword – Rotorua Lakes 2006

John Green

*Chair, LakesWater Quality Society Inc.*

This Symposium ***Rotorua Lakes 2006*** was the fifth event of its kind jointly hosted by LakesWater Quality Society and the Royal Society of New Zealand (Rotorua Branch). It's focus was ***Wonderful Lakes – What Value? Who Pays?***

For the record, the four previous Symposia were:

***Rotorua Lakes 2001 – Research needs for the Rotorua Lakes***

***Rotorua Lakes 2002 – Lakeside Communities and Sewerage***

***Rotorua Lakes 2003 – Practical Management for Good Lake Water Quality***

***Rotorua Lakes 2004 – Nutrient Targets and Cyanobacteria***

The in-lake science and action plans developed over the last six years are now at the leading edge of understanding and dealing with water quality problems. Yet the programmes of action are likely to take many decades and huge sums of money to complete.

The question of Who Pays and their economic impacts on community groups is a real issue when it comes to restoring and protecting the lakes, which are iconic to New Zealand and it's people.

This Symposium has given interested and affected parties the opportunity to speak out on their issues. At the same time experts and academics within this field, from overseas and within New Zealand, brought a wide-range of ideas, experience and perspective to the issues. Another important aspect of the Symposium is the opportunity for all those attending to meet each other and share ideas and views on an informal basis. These Proceedings record all presentations made at the Symposium.

We gratefully acknowledge the generous support of Environment Bay of Plenty Regional Council, Rotorua Energy Charitable Trust, Bay of Plenty Electricity and Rotorua Lakeside Reserve Action Group.

On behalf of the LakesWater Quality Society and the lakes themselves, I extend our sincere thanks to all those who prepared and presented papers, to the Chairman of each session – Bill Cleghorn, Gerard Horgan and Lyall Thurston, and the voluntary committee and extra volunteers who worked tirelessly to make the Symposium a success. A special thank you to Dynamics Audio Visual Ltd who organised the technology enabling us to video link with Professor Costanza in Vermont, U.S.A.

I would also like to acknowledge here the enormous contribution that our previous Chairman, Ian McLean, has put into our Society. Without his Herculean efforts I do not believe that the Lakes restoration process would be where it is today. Thank you, Ian from our Society and from the Lakes.

The restoration and protection of our Lakes will only be successful when all community groups and levels of Government work together to achieve that one goal.

## **PRESENTATIONS (In order of presentation)**

### **Historical and future significance of the Rotorua Lakes**

Don Stafford  
*Rotorua*

Tena Koutou, tena koutou, tena koutou.

I cannot imagine how anyone in 15 minutes can possibly tell the history of our beautiful lakes but the history began with the people in this country, perhaps 700-750 years ago. And after arriving in Aotearoa those people headed inland and this was where they decided they would live. I can imagine how magnificent our lakes must have looked in those days before anyone had left a footprint between the coast and Rotorua, except the discoverers. One only has to visit the edges of the lakes to see where the people of the past wanted to live, I guess as people do today, right on the edge of the water. But the way they lived left no unsightly buildings, left nothing except the remains of where they did live and a visit around the edge of the lakes would well repay the time spent in doing it. Not only was it a wonderful place to live, but the lakes provided them with all they really needed in life. It provided them with all the materials; it provided them particularly with all the food they could ever want.

I know it is often imagined that the natural species, the native fish, could not have been of any great consequence to the people. There were that I know of at least 159 individual fishing grounds within Lake Rotorua itself. The name comes from the Great Discoverer who came in about 1250 or perhaps 1300. The late Elsdon Best, a noted early Historian, left a record of one fishing expedition that he joined on Lake Rotorua, this was in the 1880s when they fished for koaro, a small fish a little bit larger than whitebait or inanga. He describes how they went out in the canoe in the evening towards Hamurana River and they began setting their nets at 8pm and by 4am they had one ton of koaro in the canoe with them. You can hardly imagine a canoe would float with a ton of koaro but that is what they caught.

There were a number of species of fish – kokopu, koaro, toitoi, inanga, koura and there was the shellfish kakahi. These provided a constant diet for the Maori people up until the middle of the 1800s when we first began interfering with the fishing of Lake Rotorua, Rotoiti, Rotoehu and Rotoma. And that is probably the most important feature of the lakes historically – it was the beginning of the European occupation of this area. When I say European I want to say this, I believe the beauty of the lakes and the lakes themselves and the history of the lakes belong to us all. I do not divide history up into Maori history or Pakeha history or anything else. I believe as a New Zealander that if you are a New Zealander and you love New Zealand, then anything that has happened in the last 1000 years is part of your history. It certainly is in my opinion part of my history.

The Maori people were very, very receptive to the first people who came into this area and welcomed them. Of course these new people realised that they were coming into a virtual paradise. One thing that was obvious, however, was the enormous number of people who were coming in, particularly after the land wars of the 1870s. It was the tourist industry and



although this is probably our greatest industry today, it was the tourist industry that began to change dramatically the value of the lakes.

One of the things that interested the tourists of course was the lakes without fish that they considered worth fishing for, trout. The introduction of foreign fish was probably the most important part of the history of our lakes. Carp were introduced at the beginning of 1872. They were taken from Napier to Lake Taupo by an armed constabulary gentleman known as Captain Morrison, and they flourished in Lake Taupo. Then a year later one of our famous armed constabulary gentlemen, Captain Gilbert Mair, brought them from Taupo to Rotorua and they flourished in Rotorua. To the Maori people this was a great thing; these carp were a wonderful source of food. In fact early visitors to Ohinemutu described how they could hardly believe the number of carp that were swimming in the shallow waters at Ohinemutu, and what amazed them even more was that the water there was hot and they felt that the carp must have been half cooked by the time they were caught by the Maori people.

The Maori people welcomed the carp. But there wasn't much sport fishing for carp and so under the auspices of the Tauranga Acclimatisation Society, and I never quite understood how the Tauranga Acclimatisation Society could possibly have the right to introduce fish into Lake Rotorua, but they did. They introduced the fontinalis, the brook trout, and they seemed to flourish. A little later they introduced brown trout and they certainly flourished. But the Maori people suddenly realised that these brown trout that were proliferating in our lakes were cleaning up all of the native fish. The fishing grounds they had owned for centuries were depleted and they began to wonder what on earth was happening. However it didn't bother them too much because the lakes were theirs as far as they knew and they decided that if there were trout in the lake, they would take the trout that were in their lake and there would be nothing wrong with that, and so they began to take the trout.

To cut a long story short, it was not long before the authorities felt that the Maori people were poaching the trout. I am not quite sure why it was considered poaching but poaching it was. Before too long the right to introduce trout into Lake Rotorua seemed to be passed over to the Auckland Acclimatisation Society. I am not sure how these things happened but I can remember reading a speech, in fact I have a copy of a speech that was made in the 1930s by the then Minister of Internal Affairs when he was talking about this problem of poaching. It began because there were reports of poaching going on in the lake. He said "The Society made application to the Government to be allowed to take over the Rotorua District" which application was conceded and the Auckland Society became the proud possessors of the wonderful waters of this lakes district.

It seems incredible to me that anyone could have simply taken over the waters of the Rotorua lakes district. Well the Maori people continued, of course to take the trout because they considered that they were fishing in their waters. This was well after the 1881 Treaty. The Maori people considered the Thermal Springs District Act of 1881 their Magna Carta. We had never signed the Treaty of Waitangi. Instead we had attended the Kohimarama Conference (July 1860), which was another meeting where we gave our allegiance, I suppose, to the Crown but we had never considered that the Thermal Springs District Act was anything other than the first great treaty. Under that Act the Government was empowered to do a great many things in Rotorua, they were permitted to start the township, to lay out gardens and

greens, and almost every clause in that Thermal Springs District Act said that the Crown could do these things, always with the approval of the native proprietors.

The native proprietors said they could never ever remember being consulted about all of these things and they still considered that the lakes were theirs, as were the occupants of the lakes, the fish. It came to a head on one occasion when it was reported that fifteen Maoris had been arrested for fishing without licences. Maoris were quite unsure what these licences were. They were hauled into Court, seven of them were prosecuted and they were fined £2 each. Only one could pay the 2 pounds and the others were sent to Mount Eden jail to spend a stretch in jail for having taken the fish from Lake Rotorua. Those sorts of things certainly did not endear the Government of the time with the affection of the Maori people.

Everything came to a head in 1906 when an old Maori called Manihera Tumatahi who had been studying at the church school in Napier, arrived home for a short holiday. There was no food in the household and he decided he would go to the Ohau Channel and there he would fish for a fish, and that is what he would eat. While he was fishing in the Ohau Channel one of the Auckland Acclimatisation Society rangers came up and asked him for his licence. He said "what licence?" The ranger explained that he had to have a licence if he was going to take a fish. Manihera said he did not know about that but it was his lake and he presumed any fish in the lake were his; however, he too was hauled into Court and fined four pounds, nineteen and sixpence. Then Reverend Frederick Augustus Bennett, the later first Bishop of Aotearoa, took the matter up and the Maori people got together and raised funding and ultimately in 1908 took a case against the Crown for the lakes bed. Well, that case went on until 1922 to the point where the Maori people were exhausted of any funding and the Crown said at the time they did not mind how long the argument went on as to who owned the lakes because they had very deep pockets. I can not vouch for the absolute accuracy of that but that is what I was told.

The Maori people then received the aid of Sir Apirana Ngata and ultimately there was an agreement made between the Crown and the Maori people that the ownership of the lakes was going to be just too difficult to solve but to save the Maori people too much of a problem, the Government would pay them £6,000 a year and the Government would assume the use of the lakes.

That is a most patchy description of what happened but in essence it seemed to me that that was one of the great problems we have had over the lakes; all beginning with the Thermal Springs District Act in 1881 under which the Crown was obliged to seek the approval of the native proprietors whenever they anticipated any moves that affected the lakes or this district. I cannot imagine that anyone could ever disagree with the fact that the Government played a rum hand in that entire episode.

Our lakes have been filled with the most wonderful stories; I only wish I had five more minutes to tell you some of the wonderful things that happened. It has some of the greatest love stories that you could ever imagine in Maoridom. You have only got to think of Hinemoa swimming across to the island to be with Tutanekai who found her in a hot pool, whipped her up to his place, they had a wonderful time.

It is the sight of one of the greatest battles that ever took place in New Zealand when Hongi Hika came down in 1823 with an army. Everybody gathered on Mokoia Island because they felt there was no way Hongi could get to them if they were on the island, and you know he dragged his canoes inland and you can actually follow every inch of that journey if you know where to look on our lakes, Lakes Rotoehu, Rotoiti and Rotorua. And when he finally attacked Mokoia Island he is reputed to have killed some hundreds of people, taken hundreds of prisoners and then left.

The lakes are our history. They are full of our history. If you go around the edge you can look at one of the main centres, Ohinemutu, what a wonderful place that is. Kawaha Point, Ngongotaha, Waiteti, Te Awahou, Hamurana, wherever you go there is a depth of history that would last you for weeks and weeks and weeks, if you enjoy history. As I said in the very beginning, I consider everything that has happened on those lakes, great or small, is part of our history. We had them to ourselves right up until the middle of the 19<sup>th</sup> century until we got mixed up with the Government. Once that happened, sadly enough, everything seemed to be at an odds end. Now, I do not blame the Government for everything because Rotorua is still a very beautiful place and the Government has spent a great deal of effort and money in making it a beautiful place, as have our District Councils and our City Councils over the years. But for me, the lakes are an imperative; they are our jewels and if we do not preserve them we are going to lose a tremendous amount.

Farming after the Second World War blossomed. I should say this too, that one of the wonderful things the Crown did in 1901 was to install a complete sewage system in Rotorua and the idea of that was to protect our lakes. However, it stayed the same for about forty years until the 1960s actually, when a visiting American biologist said that the Rotorua lake was little better than an unflushed toilet. My understanding is that on that announcement, we began to take notice of what had happened to our lakes. But we have very, very little time left to make the final moves which should restore them to something of their former beauty.

I have spent half of my life on the lakes, not only fishing but just moving across the lakes and enjoying them. Yesterday I spent half a day on Lake Rotoiti and it was rough but it was just as beautiful when it was rough and I could hardly believe that I was sailing on a lake which every now and again these days is said to be polluted. Dreadful. However we have an opportunity, I think, of solving these problems once and for all and it will be a long long step that we need to take, but I am quite certain that if we have the will and if we have the strength in numbers and if we have the right arguments, we can convince the powers that be not only that much of their future depends upon the quality of our lakes, but much of our industry depends on the quality of our lakes.

But more importantly, much of our affection depends on the quality of the lakes and I would not like to think that in the future my grandchildren or great-grandchildren or descendants of any sort might say "What a mess they've made of these things when they could have done better."

Tena koutou, tena koutou, tena koutou.



# The Value of Ecosystem Services in the Rotorua Lakes Region

**Robert Costanza**

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<http://www.uvm.edu/giee>

## **Linking ecology and economics for aquatic ecosystem management (video link-up)**

Dr Robert Costanza

*Director of the Gund Institute for Ecological Economics  
at the University of Vermont*

*Dr Costanza is an international leader and pioneer of research in Ecological Economics. He was one of the first to put a value on the ecosystem services provided by nature. He worked out how much it would cost to replace key functions of nature, such as water and air purification, by engineered systems. Throughout the world this method is now a critical part of showing how worthwhile it is to restore many kinds of ecosystems. Email: [anna.masozera@uvm.edu](mailto:anna.masozera@uvm.edu)*

### **ABSTRACT**

Dr. Costanza will discuss an approach, based on ecosystem services, for assessing the trade-offs inherent in managing humans embedded in ecological systems. Evaluating these trade-offs requires an understanding of the biophysical magnitudes of the changes in ecosystem services that result from human actions, and of the impact of these changes on human welfare. Dr. Costanza will summarize the state of the art of ecosystem services-based management and the information needs for applying it. Three case studies of Long Term Ecological Research (LTER) sites - coastal, urban, and agricultural - can be used to illustrate the usefulness, information needs, quantification possibilities, and methods for this approach.

*Please note that the full audio visual slides of this presentation are contained in a CD which is in the back pocket of these Proceedings. Many of these slides were unable to be copied into this document.*

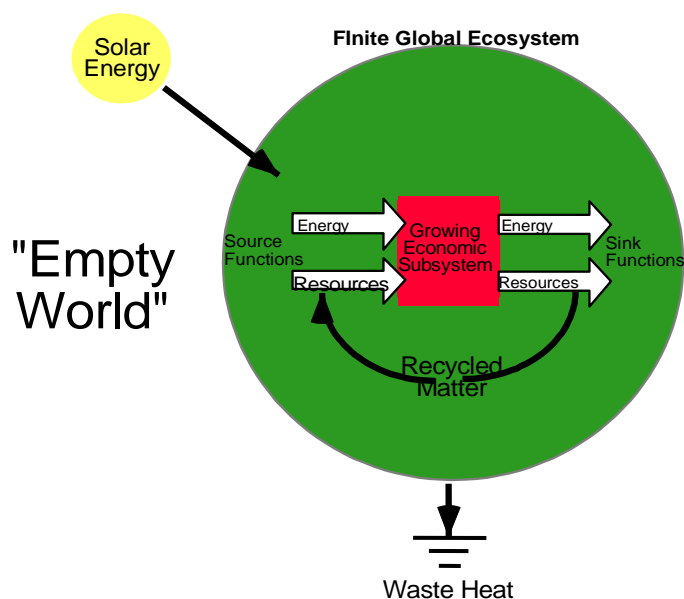
## TRANSCRIPT

Thank you. It is very nice to be with you and if you could bring up the first slide on the PowerPoint presentation, I will go ahead and get started. The first slide (above) shows a satellite image of Rotorua and I think I am looking down at the site where you are having your meeting right now. I am glad I could be with you and I did not have to expend all the carbon into the atmosphere in order to get there and back. It should have taken me about four days of traveling I think.

I would like to talk a little bit today about the value of the ecosystem services in the region that you are interested in but also to set a broader context for this analysis. By pointing out that to actually solve problems in a practical way requires that we integrate these three elements of having an adequate vision, both of how the world works and scientific paradigms and also of how we would like the world to be; what our goals are for the future. The whole idea of sustainability, I think, very clearly fits into this category. We would like the world to be sustainable, we would like the human presence to continue, and we would also like the quality of life for humans and for other species to be high.

In order to do that we have to have a better understanding of how the world works and we have to integrate that and make that consistent with our tools and analytical techniques. They have to be appropriate to that vision, as do the implementation strategies that we choose. So I would like to point out that our vision of how the world works and how we would like the world to be, both of those elements are changing dramatically and need to change if we hope to achieve those goals. We used to live in, and what our vision of the world used to be, is one of an empty world, (*Figure 1*) one in which the economic sub-system was a relatively small component and one that could not drastically affect the larger finite global ecosystem.

*Figure 1.*

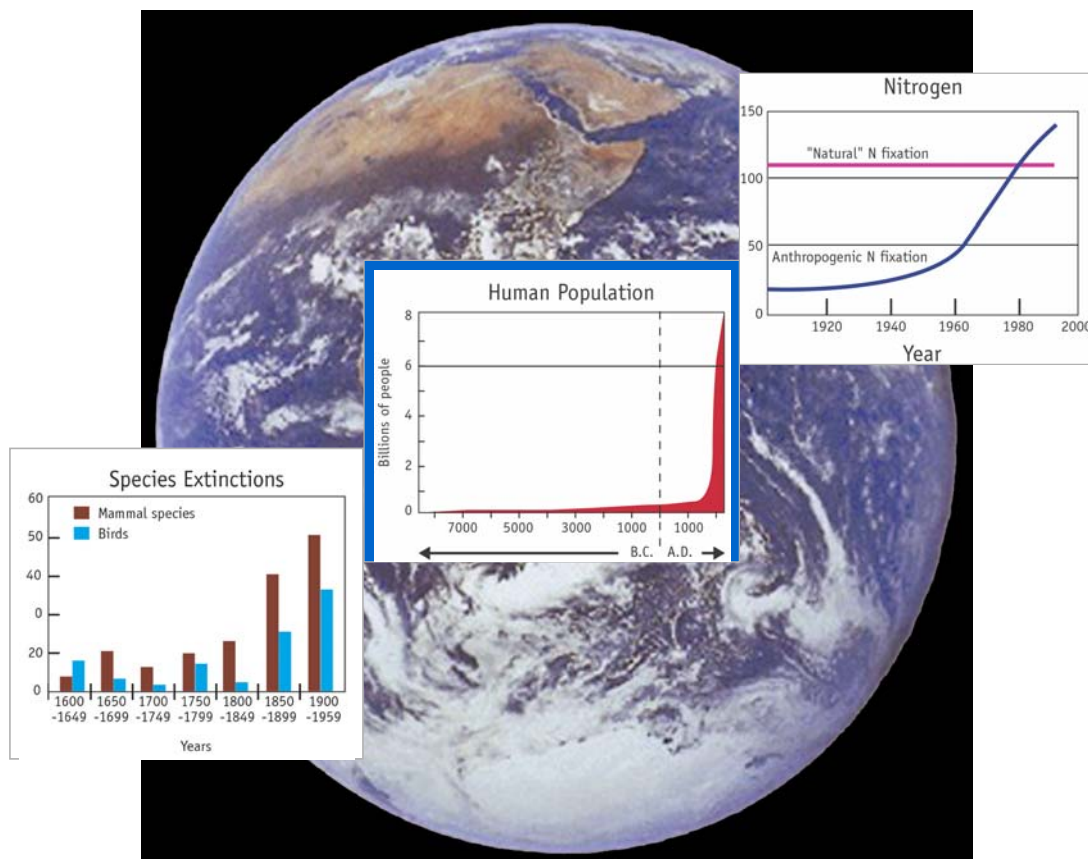




If we go to the next slide (*Figure 2*) we see a rotating globe with the night-time satellite imagery composited onto the night-time slide. This is a view of what you would see from space if all the clouds are removed from the atmosphere and you see that the human presence on the biosphere is now dramatic. All of those lights represent economic activity and population and this side of the Earth, even a hundred years ago, would have been almost completely dark. So the human presence on the biosphere has increased dramatically just in the last 100 years or so.

In the sub-slide the human population increasing dramatically over the recent historical period after a long period of very slow increase. You can also see in the next sub-slide that the nitrogen fixation on the planet earth is now largely due to anthropogenic sources, so we are beginning to affect things like the global nitrogen cycle and the global carbon cycle. The last sub-slide shows that the number of species extinction is also increasing exponentially due to human activities on the planet. We are said to be the cause of the six great species extinction on Earth or species extinction event.

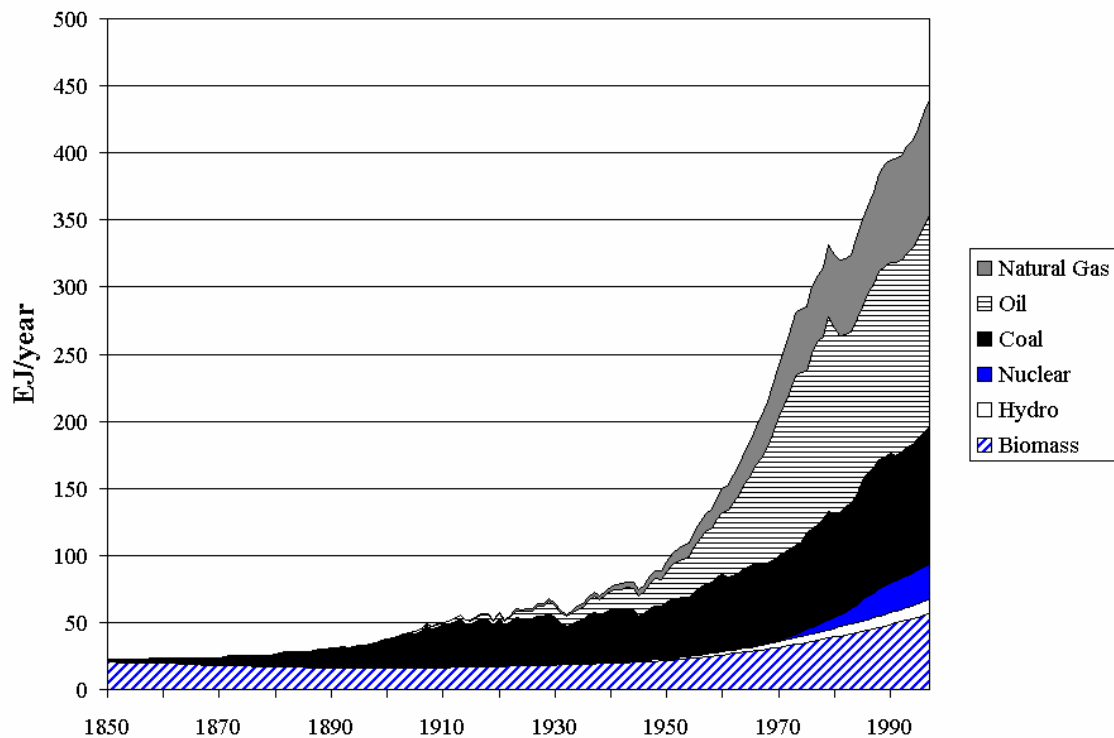
*Figure 2.*



**The Challenge: Sustainable Management of an Ever-Changing Planet**

In *Figure 3* you will see that a lot of this is due to the burning of fossil fuels by human society and this is a plot from 1850 until about the year 2000 showing the exponential increase in the rate of use of the various energy sources, mainly fossil fuels by human society. You can see the slight chink in that curve around 1950 which is a point coming to be known as the Great Acceleration where a lot of these global trends really accelerated over their previous exponential increases.

*Figure 3.*

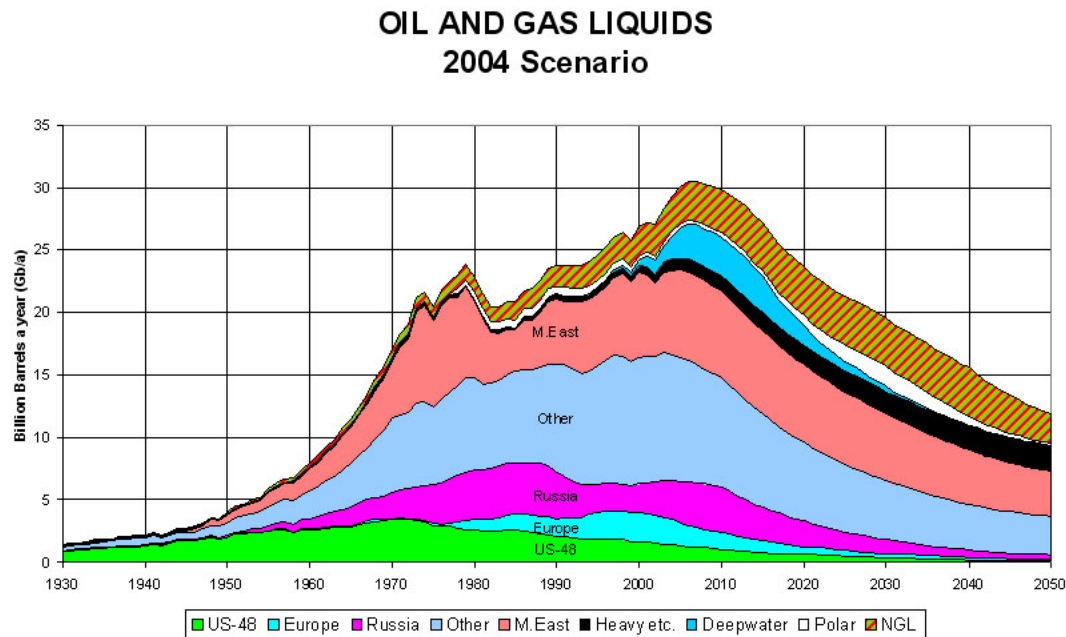


#### **WORLD PRIMARY ENERGY SUPPLY BY SOURCE 1850 - 1997**

The next slide (not shown) shows where the world's oil suppliers are, the red circles are the ultimate recoverable oil on the planet or at least an estimate of that, and then in black within that are the remaining stocks of oil. You have probably heard the term 'peak oil' and the fact that oil production is due to peak globally, if it has not already, some time in the next few years. So you can see where the remaining stocks of petroleum are located and how that affects global geo-politics.

*Figure 4* (next page) shows what we are talking about in terms of the peak oil production, these are estimates of when that peak will occur in various production zones and this estimate is somewhere around 2007/2008 after which there will be a slow decline in production. Not that we will run out of oil anytime soon but the rate of production will have peaked and that will cause the price of oil to skyrocket.

Figure 4.

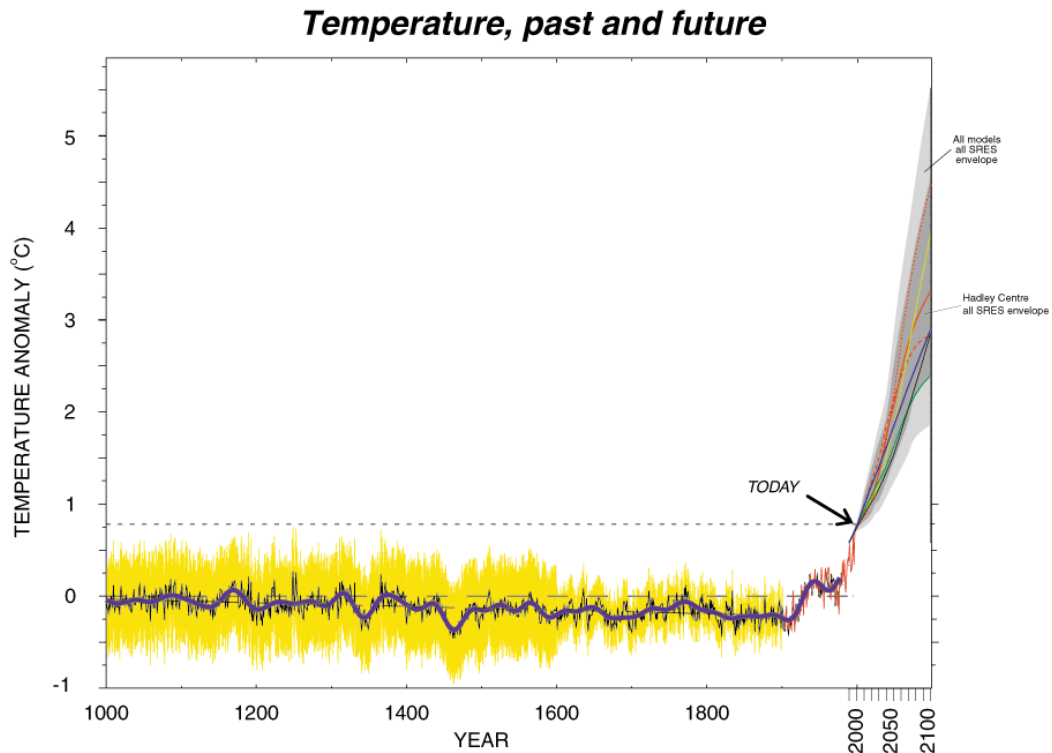


At the same time we are learning a lot more about how the ecological life support system functions. This is a slide showing a computer simulation of the global atmosphere and oceans and some of the land processes from the National Centre for Atmospheric Research. This is one of about ten global models of this type but you can see how sophisticated they have become and their ability to integrate a complex understanding of the Earth's climate system. What we are looking at here in white is relative humidity and in orange is precipitation. So you can see the major features of the Earth's weather and climate system displayed in one place, which to me is a very compelling picture of how this system functions. You can see along the Equator the Inter-tropical convergence zone; you can see the frontal systems moving across the northern and the southern hemisphere. If you look at New Zealand which is in the lower middle part of this curve, you can see the weather patterns that sweep across New Zealand and why it is relatively wet there compared to for example, central Australia or the Sahara or parts of South America. The purpose in doing these kinds of models is to understand the system so that we can realise what might happen when we make changes in that system, like putting more carbon dioxide into the atmosphere from burning all of that fossil fuel.

Figure 5 (next page) is the famous hockey-stick diagram from the latest IPCC inter-governmental panel on climate change report, which is a reconstruction of the Earth's climate – in this case the average temperature in the northern hemisphere over the last 1000 years and then the historical record of measurements up until today, and then the projections of these various climate models under various scenarios into the future. What this diagram clearly shows is that the Earth's climate over the last 1000 years was fairly stable in terms of temperature. Historically we have measurably increased the average temperature and all of the projections from these climate models into the future show significant additional changes in the next 100 years, regardless of which model or which scenario you're looking at, ranging from about 2°C to almost 6°C over the next hundred years.



Figure 5.



In *Figure 6* this is already causing significant increases in various weather related effects. In this case this is from the Millennium Ecosystem Assessment (2005) looking at the flood frequency over the various continents, showing the exponential increase in the number of floods in all continents over the last period.

Figure 6. **FLOOD FREQUENCY OVER VARIOUS CONTINENTS**

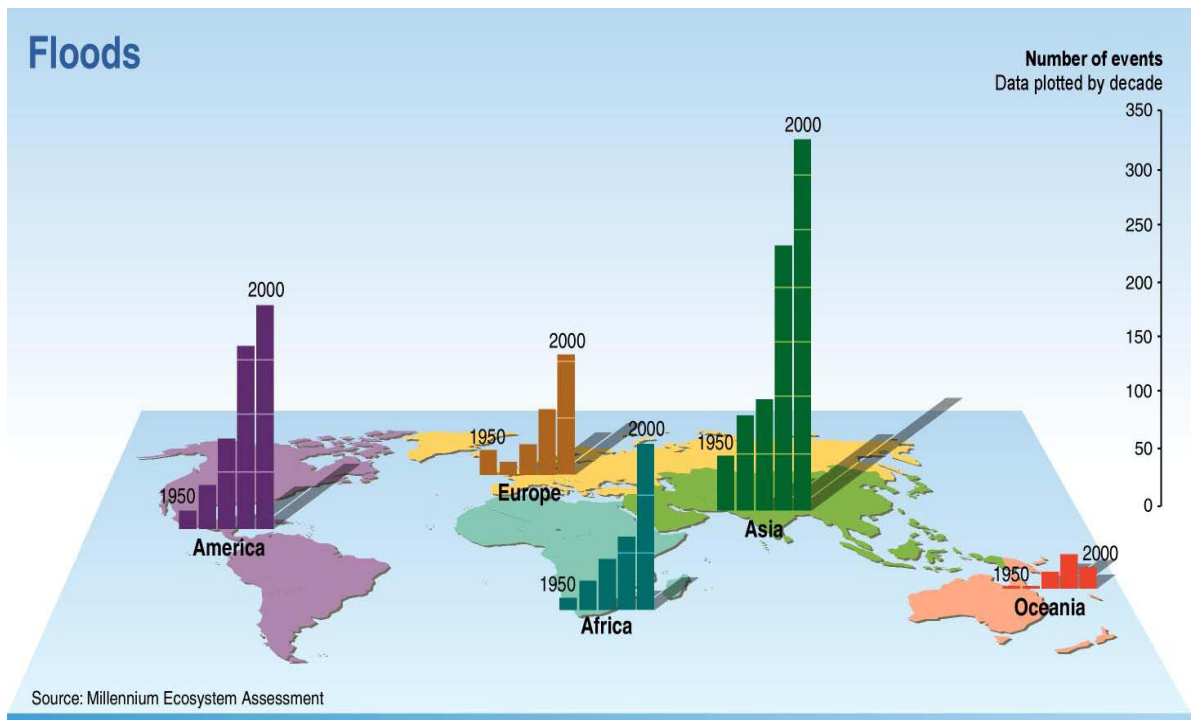
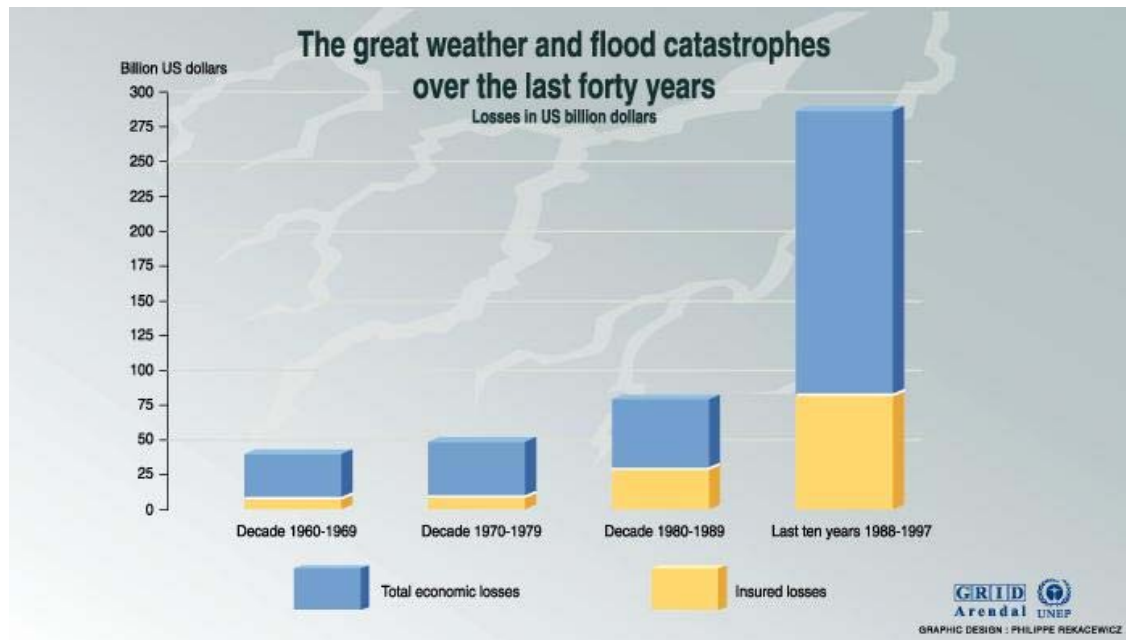


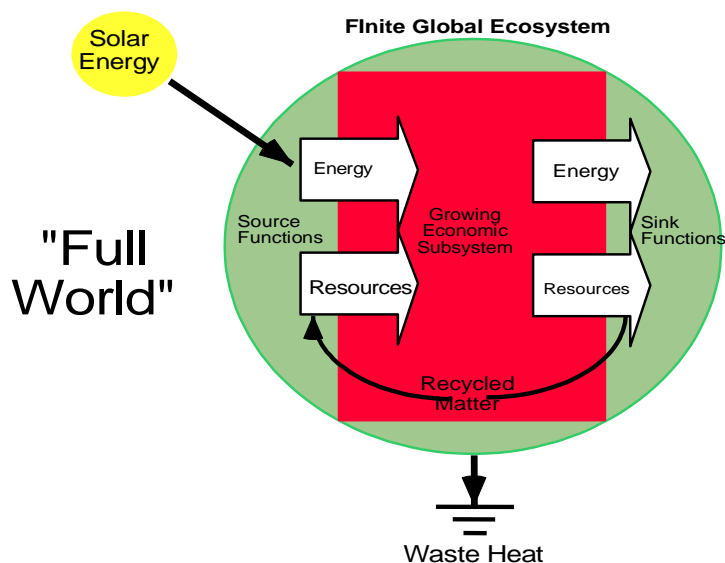
Figure 7 shows the economic damages from weather-related flood events, again showing the exponential increase in the value of those damages – partly because there is more infrastructure to damage but also partly because of the increased frequency and intensity of storms due to our messing around with the climate.

Figure 7. **WEATHER-RELATED ECONOMIC DAMAGES HAVE INCREASED**



So if we go to Figure 8 obviously we do not live in an empty world any longer; our vision of the world needs to change. We live in a full world, one in which the economic sub-system is a relatively large component; it is beginning to have effects on this finite global ecosystem and we can no longer study each of those systems independently – it is not enough to do ecology separately from economics. The real interesting and important questions are at the interface between those systems and we need to look at this system as an integrated whole.

Figure 8.



The next slide (not shown) shows what ecological economics is in fact trying to do – it is not a sub-discipline of economics and distinct from environmental economics which is that, but it is an attempt to really integrate the natural and the social sciences around this question of understanding the way the Earth's life support system functions in combination with the human sub-system.

On the next slide (not shown) there are a few words which show that both ecology and economics come from the same Greek root, *ecos*, which means house, and so ecology is literally the study of the house and economics is literally the management of the house. Ecological economics is managing the house as if we knew something about it. It has three integrated questions or goals, the first is to establish and maintain an ecologically sustainable scale or magnitude or size of that economic sub-system – we do not want it to be so large and impactful that it jeopardizes the sustainability of the life support system. The second goal is to create a socially fair distribution of resources, both within the current generation of humans and also between the current generation and future generations; but also between humans and other species that we share the planet with.

We would like to have an economically efficient allocation of resources, we do not want to use our resources inefficiently but in order to do that we have to include in that allocation mechanism all the resources that support human welfare. As is argued through the rest of this talk, many if not most of these resources are outside the market allocation mechanism. We are not allocating those resources very efficiently, we are certainly not fairly distributing them and it is arguable whether we have surpassed the ecologically sustainable scale of economic activity on the planet.

It also shows the methods that we need to employ and a trans-disciplinary dialogue is an important starting point. These kinds of problems transcend disciplinary boundaries and we need to get beyond even intra-disciplinary to transcending those boundaries if we hope to address these kinds of questions in an integrated way.

The next slide brings us to the need to focus on problems rather than tools. The next slide shows the need to build a more integrated science, one that is a better balance between synthesis and analysis. Synthesis of the type that went into building that global weather model for example, how do we put all of the pieces back together once we have taken them apart in our analytical studies. It is not an either/or situation but one where we need a better balance between synthesis and analysis.

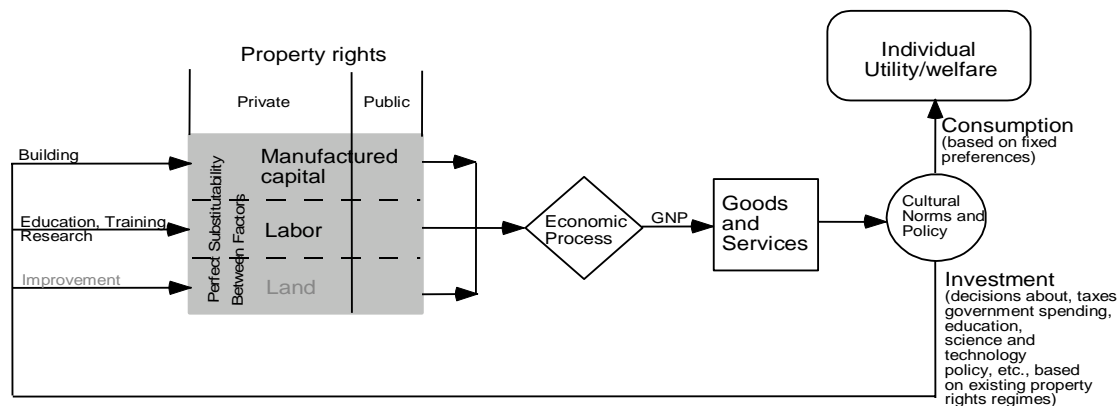
The next slide shows that we need more effective and more adaptive institutions. Our institutions need to be learning institutions, they need to acknowledge that their policies are really experiments and we need to learn from those experiments so that we can improve.

*Figure 9* is a little model of the empty world or the empty world model of the economy from the vision of the empty world. How do people that have that vision see the economy in the traditional view? You can see that there are the traditional factors of production, land, labour and capital – but land is grayed out because the assumption is that there is perfect substitutability between these factors. If we run out of land or natural resources, we simply can substitute more labour and more manufactured capital, keep the economic process

growing producing GNP goods and services which is then either consumed or reinvested to build more capital so that we can produce more in the future.

Figure 9.

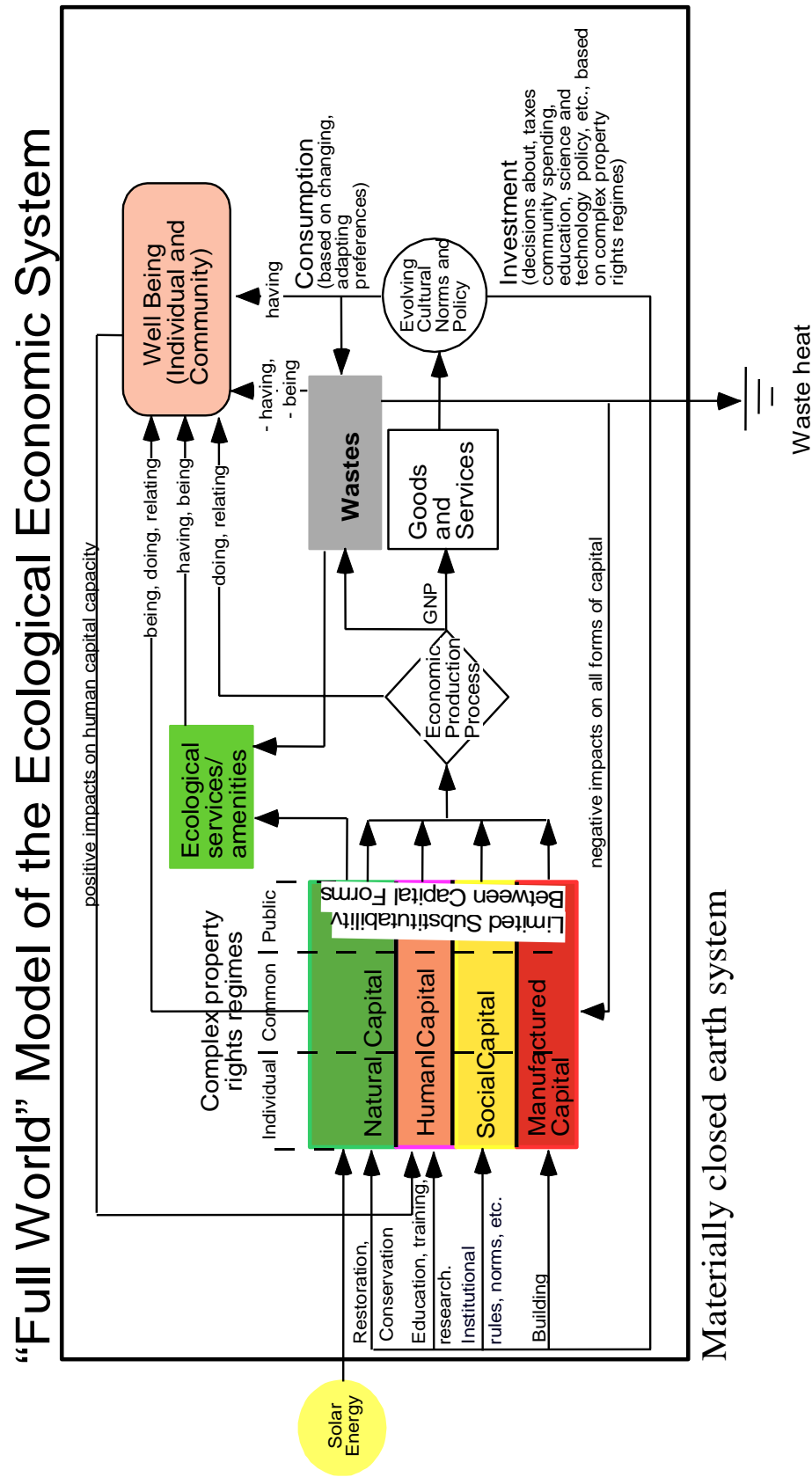
## "Empty World" Model of the Economy



Consumption of goods and services is the major factor influencing individual utility or wealth. So the goal of this economy from this vision is to produce more so that we can consume more. More consumption is more welfare, the more the better. There is a fairly simple distinction between private and public property rights and you can see there is nothing in this vision of the world that would in any way limit the exponential increase of those goods and services into the indefinite future. I would argue that this model of how the economy works is the one that largely drives a lot of our policy making these days.

Figure 10 (next page), I think, is a better model, the full world model, one that acknowledges the fact that we do not live in that empty world any longer; it recognizes that we live on a materially-closed earth system, so everything has to go somewhere. There is no way for at least the material component of economic production to increase exponentially forever. It also acknowledges that there is limited substitutability between the poorer types of capital noted there, the traditional manufactured capital at the bottom but also natural capital. Rather than calling it land, we call it natural capital just to emphasize the fact that natural resources, natural ecosystems, are positive partners in this production process and they contribute ecological services and amenities which both help the conventional production process and also contribute directly to human wellbeing, without ever going through markets.

Figure 10



From: Costanza, R., J. C. Cumberland, H. E. Daly, R. Goodland, and R. Norgaard. 1997. *An Introduction to Ecological Economics*. St. Lucie Press, Boca Raton, 275 pp.

So there are a lot of non-marketed ecosystem services that contribute to wellbeing. There is also human capital, instead of calling it labour, that emphasizes that it is more than just the physical labour of people, it is their education, their health, their welfare, all of the things that are contained in individual humans that can contribute to the economy and to their own wellbeing.

Finally there is social capital, all of the inter-connections between people, both formal and informal that is very important in contributing to the economic process and directly to human wellbeing. Another distinction in this model is recognizing that human wellbeing is a much more complex function. It depends on consumption only up to a fairly low threshold beyond which the psychological research shows that there is a very poor correlation with additional consumption and wellbeing, so other factors then come into play, including the relationship with the three types of capital that we have mentioned and the benefits of ecosystem services and social capital.

From this perspective of a full world model, it is a different vision of how the world works and how we would like the world to be. We would like to provide high levels of human wellbeing into the indefinite future. In order to do that we have to understand that providing that wellbeing is a complex function of these various types of capital that we have mentioned and embedded in an ecological life support system.

If we go to *Figure 11* based on this idea, we need to move beyond the confrontational debate about the environment versus the economy. The environment is not a luxury good or something that we can do without. The environment and natural capital is a key asset that supports human wellbeing and the other three types of capital. So we need to take a broader view of what the economy is, that includes all four types of capital and a broader perspective on how to assess our assets and how those assets contribute to sustainable human wellbeing.

*Figure 11.*

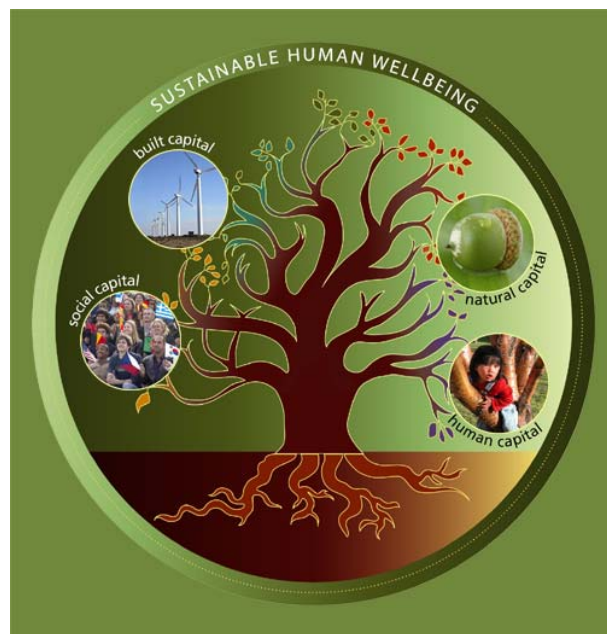
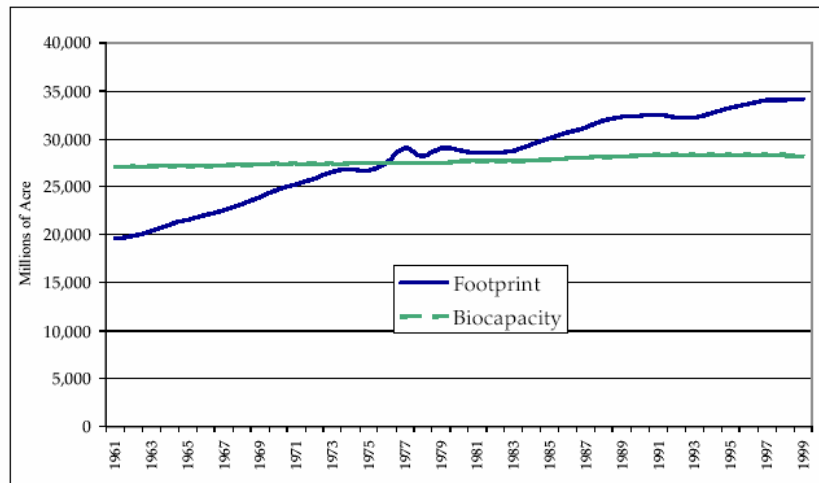


Figure 12 shows that as far as the sustainability element is concerned, some have argued this is a plot for redefining processes, estimate of the ecological footprint in blue, compared to the global bio-capacity. This is the number of acres that are required to sustainably support the human population. By their estimate we surpassed that bio-capacity about 1975 and since then we have been living off capital. We have been degrading our natural capital in order to support human welfare, obviously not a sustainable thing to be doing.

**Figure 12. Humanity's Total Footprint 1961-2000**



The next slide (not shown) shows where some of our common measures of welfare for the economy fit in and how they need to be improved. Conventionally we think of the health of the economy as being measured by GDP or GNP. This is not a measure of economic welfare, it is simply a measure of economic income or activity and it is only the marketed portion of that economic activity that GNP measures. If you use GNP as a measure of health of the economy, you are making some very strange assumptions; it was never intended to do that. For example, if there is an oil spill, someone has to clean up, that leads to more activity and increases in GNP, even though one would not argue that that is an improvement in welfare. Bad things happening can increase GNP if they require more activity; more healthcare costs, because of air pollution, would increase GNP, more storms, more war, more pestilence would all increase GNP but obviously that is not a good way to be measuring things.

What we really want to measure are some of the things in the right-hand columns, economic welfare or human welfare. Economic welfare tries to at least distinguish between the positive and the negative sides of GNP. It tries to subtract out the negative things and add on some positive things that are left out. An example would be the ISEW or Index of Sustainable Economic Welfare and I will talk a little bit more about that index just to show you how that gives you a different picture. Beyond that, we would really want to be measuring human welfare or human needs – how well are human needs being met, and then an efficient economy in that context would be one that meets those human needs with as little consumption as possible, rather than equating consumption with welfare.

The next slide quotes from Robert Kennedy showing that it has long been recognized that GNP does not really measure the right things in terms of our national welfare.

*The gross national product does not allow for the health of our children, the quality of their education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages; the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage; neither our wisdom nor our learning; neither our compassion nor our devotion to our country; it measures everything, in short, except that which makes life worthwhile.*

Robert F. Kennedy, 1968

The more recent quote from John Perkins makes the same point that we need to go well beyond those sorts of measures of economic wellbeing.

*Some would blame our current problems on an organized conspiracy. I wish it were so simple. Members of a conspiracy can be rooted out and brought to justice. This system, however, is fueled by something far more dangerous than conspiracy. It is driven not by a small band of men but by a concept that has become accepted as gospel: the idea that all economic growth benefits humankind and that the greater the growth, the more widespread the benefits.*

John Perkins, Confessions of an Economic Hit Man, 2004

The IPSW or GPI the Genuine Progress Indicator is a version of the ISEW, intended to make much better approximations since they adjust for income distribution, the value of social and natural capital and other things.

GDP measures marketed economic activity, not welfare ISEW (Index of Sustainable Economic Welfare) or GPI (Genuine Progress Indicator) are intended to be better approximations to economic welfare, since they adjust for:

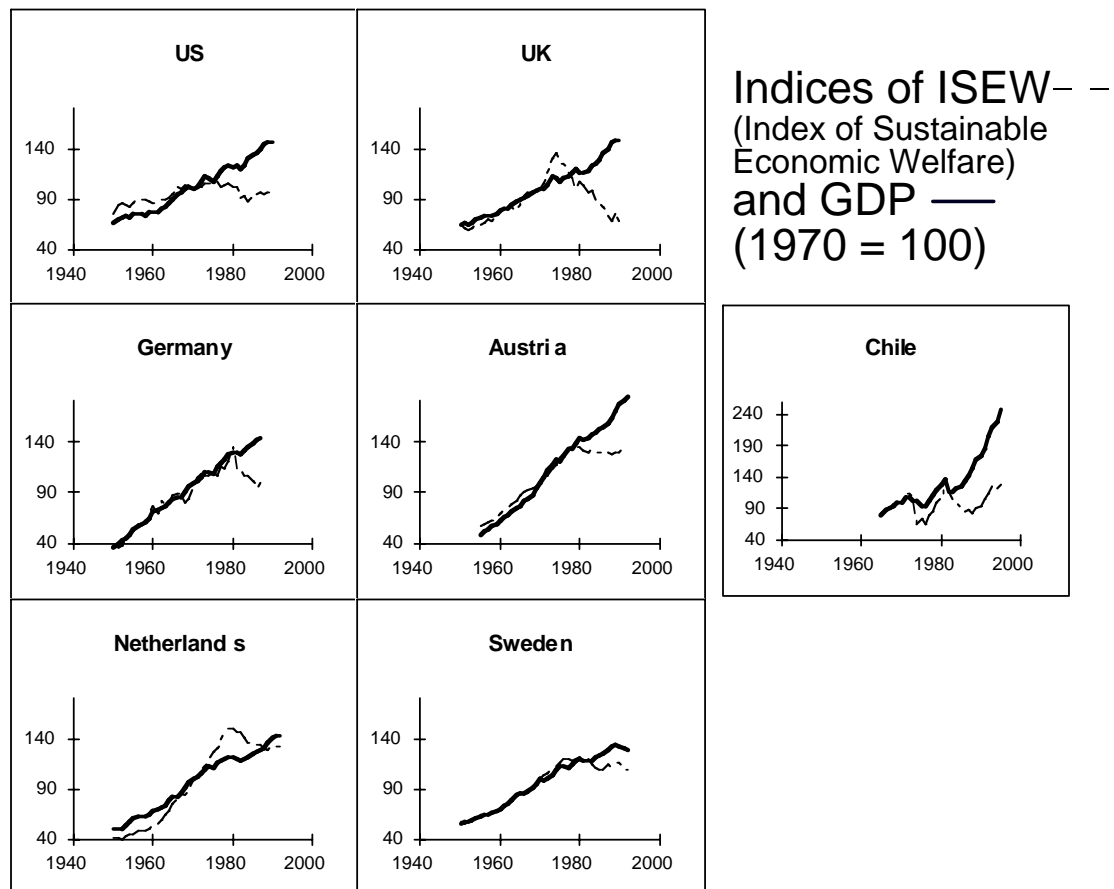
- *Income distribution*
- *Value of Social Capital*
- *Value of Natural Capital*
- *Value of Non-Marketed Household Work*
- *and other things...*

The next slide (not shown) is just a list of the elements that go into the ISEW or GPI starting with personal consumption expenditures weighted by income distribution. The other elements in black are adding the value of household labour, volunteer work, services of household capital. All the things in red are subtracted, so the cost losses of social capital like the cost of crime and family breakdown, the cost of leisure time, the cost of commuting for example - and then losses of natural capital, the cost of water, air, noise pollution, loss of wetlands and farmlands. Some of the things that you are talking about at this conference need to be embedded directly in these measures of welfare for the economy.

In *Figure 13 (next page)* are examples of ISEW compared with GDP for several countries. For the US, even though GNP has been going up steadily, ISEW peaked in around 1975-1980 and has been turning downward ever since. The US economy has not been producing additional welfare for its citizens; it is in a period of what Carmen Daly has called “the uneconomic growth”. The economy is growing, the activity level is increasing but it is not producing more welfare for its citizens, because of all of the costs of depletion of natural and social capital. Similar sorts of pictures with different timing for other countries are also shown here.

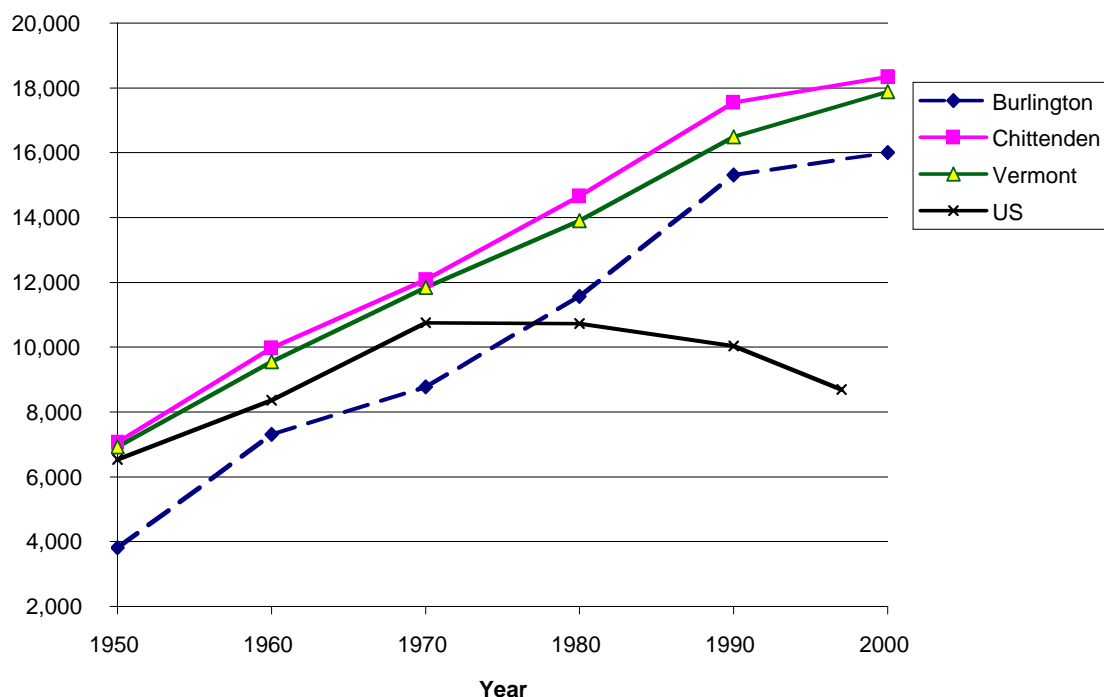


Figure 13.



We did a study recently of the State of Vermont and the city of Burlington and the county that it is in, just to see if there was some variation within the US, and *Figure 14. (next page)* shows that there is significant variation that Vermont is now about double the GPI per capita than the national average, largely because Vermont's better handling of its natural capital and its social capital. More attention to these non-conventional economic indicators therefore producing an economy that is much healthier. Taken in these broader terms we have a better picture of what the economy is.

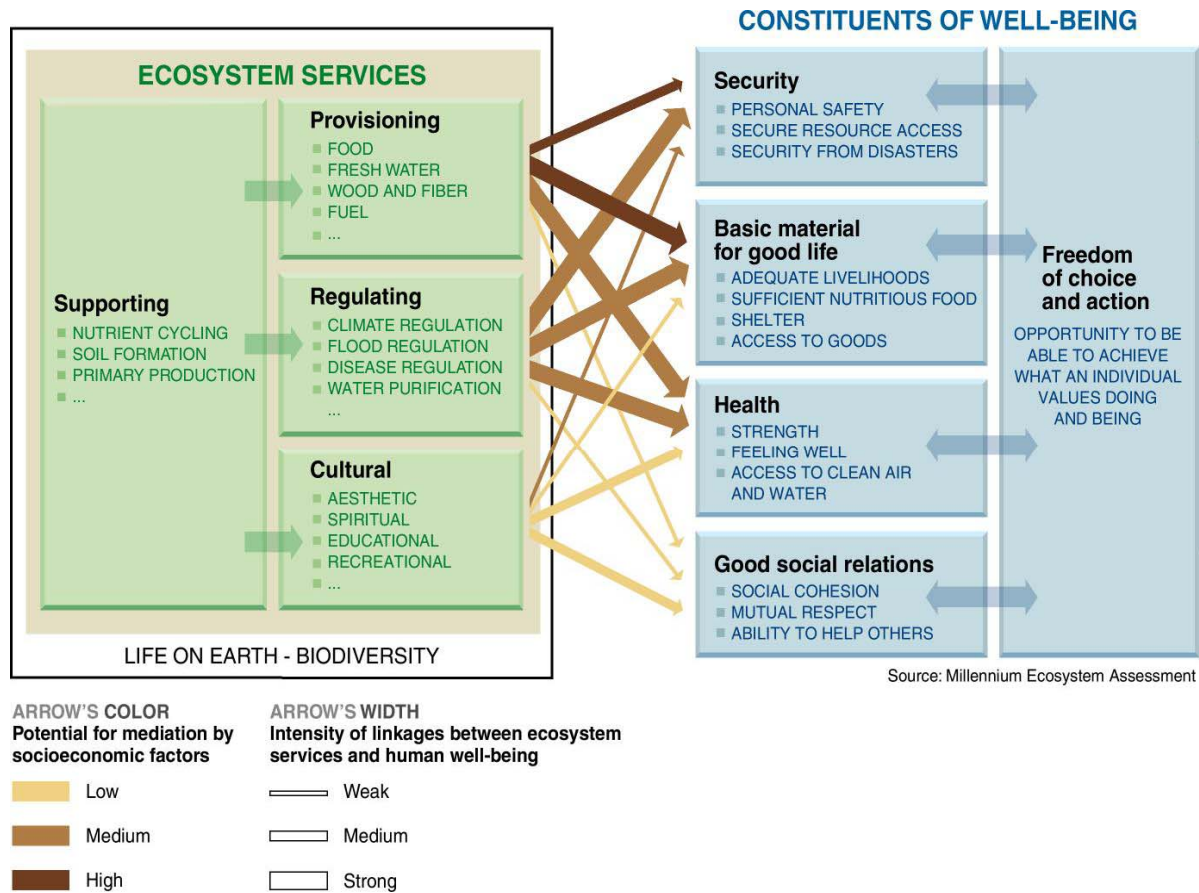
Figure 14. GENUINE PROGRESS INDICATOR (GPI) PER CAPITA



This idea then of ecosystem services is a key component in the next slide (not shown) because ecosystem services contribute significantly to human welfare. Ecosystem services are defined as “those functions of ecosystems which contribute to human welfare either directly or indirectly”. On the left you see a list of ecosystem services in the paper published in *Nature* (1997) and on the right are some of the functions of the ecosystems that support those services. They range from very global level things like gas and climate regulation to more regional things like water supply, water regulations, disturbance regulations, flood control, erosion and sediment control, forming soil, cycling nutrients, treating waste. Many of these things do not impact people directly but do affect their welfare indirectly. Some other things further down the list like food and raw material production, recreation, cultural amenities, do affect people’s perceived welfare more directly. It is important to take into account all of these services when we’re assessing the functioning of ecological systems.

If we go to *Figure 15 (next page)* this idea of ecosystem services has recently been the focus of the Millennium Ecosystem Assessment (2005) which was a four year, 1,300 scientists, effort similar to the IPCC effort to assess the status and trends of ecological systems. They lumped these services into four categories: Supporting, Provisioning, Regulating and Cultural Services, then clearly pointed out the connections between those services and the various constituents of human wellbeing. The next slide is another table, listing these services in a recent paper by Steve Harbour and myself and several others – again taking this lumping into Supporting, Regulating, Provisioning and Cultural Services and listing some of the major services that we are talking about and with examples.

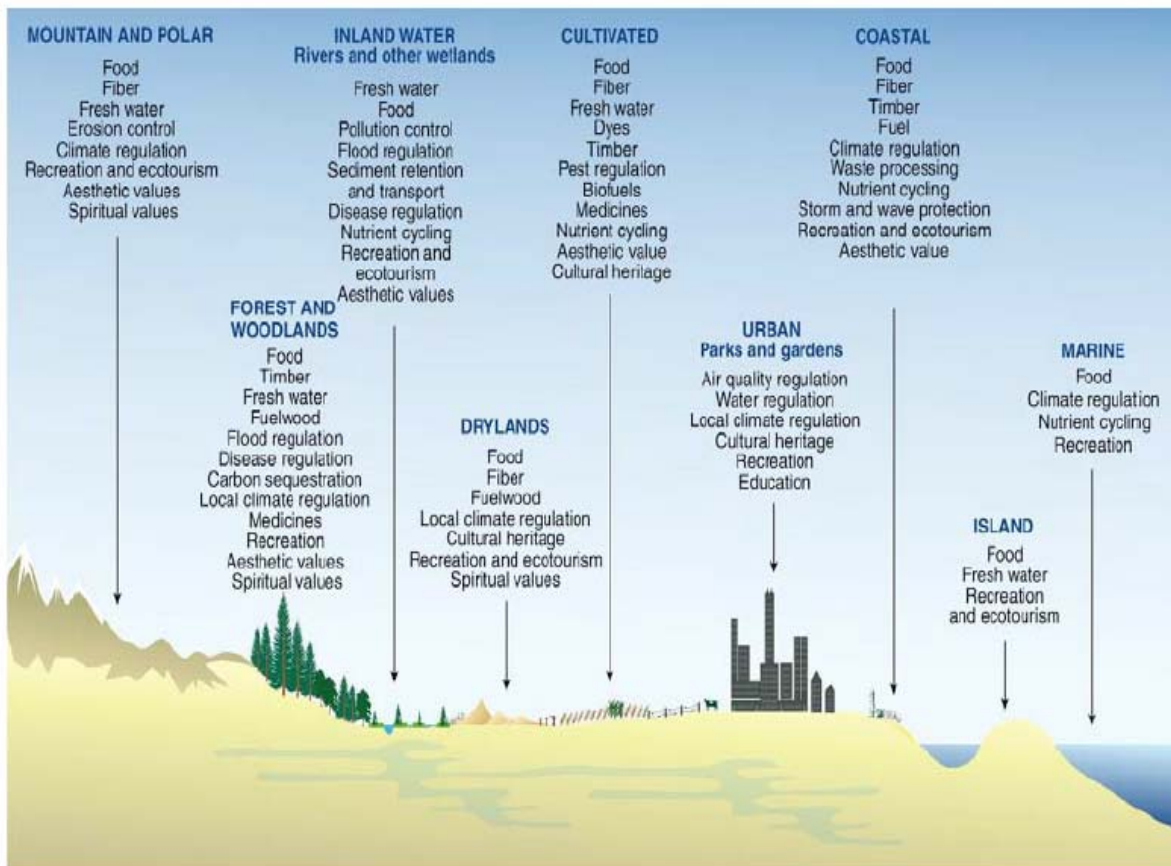
**Figure 15. FOCUS: CONSEQUENCES OF ECOSYSTEM CHANGE FOR HUMAN WELL-BEING**



There are a broad range of functions and services that ecosystems provide that the general public is only vaguely aware of, certainly ecologists and other natural scientists are aware of at least the functions of these systems, but making that link between the functions of ecosystems and supporting human welfare, I think, is what we have been trying to do and need to do more of, and is what the Millennium Assessment has done.

*Figure 16. (next page)* is from the Millennium Assessment pointing out the different kinds of services that are provided by the full range of ecosystems across the landscape. It is the landscape as a system that often provides many of these services.

Figure 16. ECOSYSTEM SERVICES AND LAND COVER TYPES



The next slide (not shown) is a movie showing data collected and synthesized from satellite observations of net primary production on the biosphere, both terrestrial and marine over about a four year cycle. You can see the greening up of the northern and the southern hemisphere and also the tremendous amount of productivity coming from the oceans of the world. Just to point out that it is now possible to get a much better handle on how ecosystems are functioning at many different scales all the way up to the global scale and trying to make this connection between that functioning of those systems and the services they are providing.

How do we value the services that these ecosystems provide? I want to just point out a couple of things with *Figure 17 (next page)*, the first being that the value of something relates to the goals being served and so we can not talk about the value of an ecosystem until we have identified what goal it is serving. I have listed in this slide the three goals that we talked about of efficiency, fairness and sustainability, and pointed out how one would assess value depending on which of those goals one was talking about. The conventional economic valuation is focused almost exclusively on the efficiency goals; it looks at people as being individuals with preferences already fixed. They do not need to talk to each other, nor need a lot of scientific influence. It is presumed they already know what they like and one assesses people's willingness to pay for various items, either through their market decisions or through some sort of survey technique that gets them to state their willingness to pay in one way or another.

Figure 17.

### Valuation of ecosystem services based on the three primary goals of efficiency, fairness, and sustainability.

Goal or Value Basis	Who votes	Preference Basis Required	Level of Discussion Required	Level of Scientific Input	Specific Methods
<b>Efficiency</b>	<i>Homo economicus</i>	Current individual preferences	low	low	willingness to pay
<b>Fairness</b>	<i>Homo communis</i>	Community preferences	high	medium	veil of ignorance
<b>Sustainability</b>	<i>Homo naturalis</i>	Whole system preferences	medium	high	modeling with precaution

from: **Costanza, R. and C. Folke. 1997.** Valuing ecosystem services with efficiency, fairness and sustainability as goals. pp: 49-70 in: G. Daily (ed.), *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington, DC, 392 pp.

A lot of economic valuation methods are focused on this efficiency goal but I think we need to go further and look at the fairness and sustainability goal, which would take some different kinds of methods. We would look at community preferences, not necessarily individual preferences. That would require a lot of discussion and scientific input and John Rawle's idea of "the veil of ignorance" as a technique might be useful in these sorts of discussions. If people know where they stand in society, they would vote in a fairer way. The sustainability goal would require that we look at the whole system, including humans and non-humans, with a lot of scientific input and require some sort of modeling exercise to get at whether or not various items are enhancing sustainability or not.

Figure 18 (next page) is an example of valuation techniques that are focused on the efficiency goal. But a few of them, like the group valuation at the bottom, at least start to get at the fairness goal and the marginal product estimation and can then bring in some of the modeling and the sustainability kinds of goals. You have probably heard of many of these methods – contingent valuation for example is one that is used to survey people and ask them how much they would be willing to pay in one way or another. These sorts of methods are useful but they are limited to the kinds of services that people have some knowledge about, for example recreation, cultural amenities, aesthetic kinds of services. But they may not be very helpful for services that people do not know much about, like water supply, climate protection or soil formation. In which case we may need to use some of the other methods like replacement cost or avoided cost or some of the marginal product estimation methods using modeling.

Figure 18. **EXAMPLE VALUATION TECHNIQUES**

<p><b>avoided Cost (AC):</b> services allow society to avoid costs that would have been incurred in the absence of those services; flood control provided by barrier islands avoids property damages along the coast.</p> <p>•<b>Replacement Cost (RC):</b> services could be replaced with man-made systems; nutrient cycling waste treatment can be replaced with costly treatment systems.</p> <p>•<b>Factor Income (FI):</b> services provide for the enhancement of incomes; water quality improvements increase commercial fisheries catch and incomes of fishermen.</p> <p>•<b>Travel Cost (TC):</b> service demand may require travel, whose costs can reflect the implied value of the service; recreation areas attract distant visitors whose value placed on that area must be at least what they were willing to pay to travel to it.</p> <p>• <b>Hedonic Pricing (HP):</b> service demand may be reflected in the prices people will pay for associated goods: For example, housing prices along the coastline tend to exceed the prices of inland homes.</p> <p>•<b>Marginal Product Estimation (MP):</b> Service demand is generated in a dynamic modeling environment using production function (i.e., Cobb-Douglas) to estimate value of output in response to corresponding material input.</p> <p>•<b>Contingent Valuation (CV):</b> service demand may be elicited by posing hypothetical scenarios that involve some valuation of alternatives; people would be willing to pay for increased preservation of beaches and shoreline.</p> <p>•<b>Group Valuation (GV):</b> This approach is based on principles of deliberative democracy and the assumption that public decision making should result, not from the aggregation of separately measured individual preferences, but from <i>open public debate</i>.</p>
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We need to use a broad range of methods that acknowledge that people may or may not be well informed about the contribution of ecosystem services to their welfare. We can not only use preference based methods, we need to include those but also move beyond to ones that might better capture the full value of those services. The next slide is the article mentioned in *Nature*, published in 1997<sup>1</sup>, now the second most cited article in the ecology environment area. It has had some significant impact on people's thinking about the natural world and the value of ecosystem services and natural capital. A small quote:-

*"The services of ecological systems and the natural capital stocks that produce them are critical to the functioning of the Earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of the planet.*

*We have estimated the current economic value of 17 ecosystem services for 16 biomes, based on published studies and a few original calculations. For the entire biosphere, the value (most of which is outside the market) is estimated to be in the range of US\$16–54 trillion (1012) per year, with an average of US\$33trillion per year. Because of the nature of the uncertainties, this must be considered a minimum estimate. Global gross national product total is around US\$18 trillion per year."*

The next slide (not shown) is a summary of the results from "*Nature*" showing in the middle column the value that we estimated across all seventeen of those services, added together in dollars per hectare, per year, and you can see that lakes and rivers were estimated to have a

fairly high value close to US\$8,000-9,000 in 1994. Wetlands in general were exceedingly high in their value estimate, as were some of the marine systems like estuaries and algae beds and coral reefs for example. Part of the reason for this is that some of these systems have not been studied as well as others. You can see there are a couple of blank spaces in the middle column – desert tundra, for example. Not because those systems have no value but because there were really no studies at the time of the value of the system. Some of the other numbers may also reflect that lack of study rather than simply low numbers. Nevertheless, the total value that we came up with for all of these services globally was in the order of \$33 trillion dollars a year which is significantly larger than the global GNP at the time.

One could argue that far from being a luxury good, the environment is really the majority of welfare for people on the planet. Of course there were problems with the *Nature*<sup>2</sup> (1997) paper and what we did there, in fact the largest section in that paper was on problems, caveats and issues, and the twelve issues that we identified – not to go into any detail on these – but solving any of these problems, except perhaps number six, would lead to the larger values rather than the smaller values. For example, in the first one the estimates were not complete as I already mentioned. Obviously as we gain more information and add those values in, the numbers will only go up.

So the conclusion is, yes there were issues with how we did the study, but what we came up with was a conservative estimate by almost any means and the true value is almost certainly significantly larger than even the one that we estimated. If we go to the next slide, (not shown) remember the night-time satellite image from the beginning of the presentation, if you plot that against gross state product in the US, you get a pretty good correlation indicating that the night-time satellite image can be used to spatially display conventional economic activity, gross national product for example.

The next slide (not shown) you will see that spatial distribution in the upper frame, you can see the conventional economic activity displayed at a 1 square kilometre resolution and in the lower right-hand part of that you can see the north-east quarter of the US just to show you how spatially explicit that can become, and the State of New Jersey is outlined in red there. I do that for a reason which I will show in a second. In the next slide we do the same thing with the value of ecosystem services, plotted again at the 1 square kilometre resolution, and here you see a very different distribution of wealth from those ecosystem services as compared to the wealth being generated by conventional built capital and conventional economic activity. In the next slide we can do this sort of analysis at much higher spatial resolutions as well. This is showing a study we are working on right now for the State of New Jersey, their Department of Environmental Protection, to try and estimate the value of the natural capital assets of that State and their ecosystem services, so they can use that in their planning processes.

If you go to the next slide, you can then see the combination, the sub-total of the ecological and the economic product for the globe and for that north-east border as well, again giving a very different picture of where the wealth of nations is really coming from. In the next slide, we aggregate that back to the national scale and look very quickly at the ecosystem services being produced by country, and the next slide would be the aggregate of the ecosystem services and the economic product by country, and the final slide in that sequence is the sub-total per capita.

Where is the population that is actually the richest? It is not in the places necessarily that you would expect, the US and many parts of Europe are not in the highest categories any longer. Australia and New Zealand, however, are up there, as are some countries in Africa and South America.

The next slide is also from the Millennium Ecosystem Assessment, (Morgan William's *Figure 3*) pointing out that degradation of ecosystem services often causes significant harm to human wellbeing and that when we take intact ecosystems and convert them – in this full world context we are talking about systems that are now marginal for agriculture and other uses – we often can reduce the total social value of those systems. Here a few examples of intact wetlands which are converted to intensive farming and if you include all of the ecosystem service values that we have been talking about, you are actually reducing the social value of those systems by making that conversion.

The next slide is from a paper that we did in 2002 with Andrew Balmford IGNS 2004, Groundwater age, time trends in water chemistry, and future nutrient loading in the Lakes Rotorua and Okareka area. Client Report 2004/17 IGNS<sup>3</sup> and several others which took this idea and said hypothetically, what would it cost us to conserve our natural capital at the global scale? The scenario there was to expand the global reserve network to one covering 15% of the global terrestrial biosphere and 30% of the marine biosphere. That would be up from about 6% now for the terrestrial and zero for the marine biosphere. That would cost in the order of 45 billion dollars a year to expand that network and to maintain it. On the other hand, the social benefits, the net value of the ecosystem services from the intact versus the converted systems, would be in the order of 4 to 5 trillion dollars a year, so there is a benefit cost ratio of roughly 100:1 and again this is probably a conservative estimate.

## **Economic Reasons for Conserving Wild Nature**

### **Costs** of expanding and

maintaining the current global reserve network to one covering 15% of the terrestrial biosphere and 30% of the marine biosphere = \$US 45 Billion/yr

**Benefits** (Net value\* of ecosystem services from the global reserve network) = \$US 4,400-5,200 Billion/yr

\*Net value is the difference between the value of services in a "wild" state and the value in the most likely human-dominated alternative

**Benefit/Cost Ratio = 100:1**

(From: Balmford, A., A. Bruner, P. Cooper, R. Costanza, S. Farber, R. E. Green, M. Jenkins, P. Jefferiss, V. Jessamy, J. Madden, K. Munro, N. Myers, S. Naeem, J. Paavola, M. Rayment, S. Rosendo, J. Roughgarden, K. Trumper, and R. K. Turner 2002. Economic reasons for conserving wild nature. *Science* 297: 950-953)



This is a really good investment right now for society to preserve its natural capital assets. The only benefit cost ratio I have run across is for oil companies investing in political campaigns in the United States. In the next slide (not shown) we get into more detail about the changes in ecosystem services that might arise from various kinds of activities at a smaller scale. This is an example from an agricultural watershed in Iowa that is also included in the Farber et al paper<sup>4</sup>.

This looks at the different scenarios and what would happen to some of the selected ecosystem services, in this case we're looking at soil retention and a positive value means more retention or less erosion. Nutrient regulation, again positive means more retention and food and genetic resources. You can see the columns that are the current erosion run-off and profit per hectare and then the change in service relative to the current landscape from three different scenarios. One was called the production scenario, a water quality scenario and a biodiversity scenario, showing that the biodiversity scenario actually leads to the highest increase in value – well the highest for the food and genetic resources but different values for the other ones.

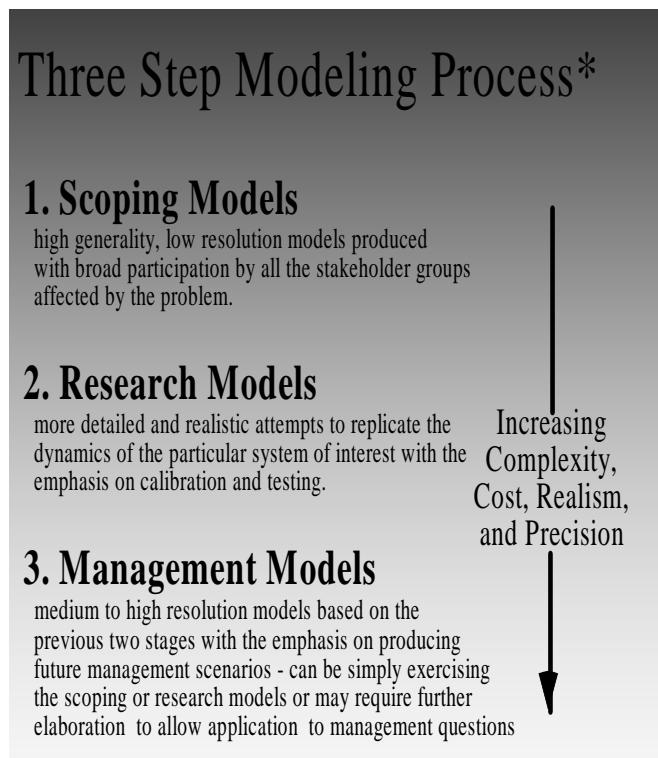
When you then put various weights on those different services, because it is hard to evaluate those changes without somehow combining them into a single unit, the first one is in soil retention unit, the second one is in kilograms and the third one is in dollars. So we need some sort of weighting system and that is where the value of these ecosystem services come in and then you get the conclusions on the right-hand side which are the value of the service changes per hectare, the value times the change in service, and that allows you to use this idea of ecosystem service to evaluate the different scenarios. We have the production scenario with the low and the high value per unit listed, the water quality scenario and the biodiversity scenario and the bottom line can be assessed and you can see that the water quality scenario seems to be the best one under these conditions. One that preserves water quality by increasing soil retention and helping nutrient regulation does a better job than one that emphasizes just simply food and genetic resources production.

The next step in this is to build more integrated models<sup>5</sup> that can integrate both ecological and the economic sides of the system and these kinds of models have some unique characteristics. One of them that I will emphasize is that they can be used as ways to build consensus about these complex systems and problems. You can do that by constructing the models in an open participatory process, where all of the stakeholders involved work together to conceptualise the system and also build models that are more sophisticated as you go.

## **Integrated Ecological Economic Modeling**

- **Used as a Consensus Building Tool in an Open, Participatory Process**
- **Multi-scale, Landscape Scale and Larger**
- **Acknowledges Uncertainty and Limited Predictability**
- **Acknowledges Values of Stakeholders**
- **Simplifies by Maintaining Linkages and and Synthesizing**
- **Evolutionary Approach Acknowledges History, Limited Optimization, and the Co-Evolution of Humans and the Rest of Nature**

These models should be multiple scales from the landscape scale and larger, acknowledge uncertainty and limits of predictability of these complex adaptive systems, acknowledge the values that stakeholders bring to the process, that simplify by maintaining the major components and linkages rather than zeroing in on some small part of the system which may not be relevant, and by acknowledging that these are evolutionary systems with limited optimisation and that humans are co-evolving with the rest of nature.



If we go to the next slide, this can be done in a three step process where the first one is to build this fairly high generality and low resolution scoping model that the stakeholders can participate in and using that exercise to guide the development of more sophisticated research and management models with higher resolution and better calibration. It is important to do that first step, both to engage the stakeholders and also to figure out where the real problems are. There are a couple of recent books<sup>6</sup> on this topic, on mediated modelling and landscape simulation modelling. The one on the left focuses on the process of doing these scoping models and the one on the right includes that step as well as the further two steps of research and management models at the landscape scale.

If we go to the next slide (not shown), because it often becomes important in these sorts of modelling exercises to look at the entire landscape and I would argue for your problem here in Rotorua that it is really a landscape level sort of problem. How do these lakes fit into the larger landscape and what is happening at the watershed scale? Those are where the policy decisions really need to be taken and so developing a landscape scale sort of approach to these problems usually proves to be essential.

We developed this spatial modelling framework and some computer software to allow us to be able to do this kind of thing. The next slide points to a couple of applications, I will not go into details and you will find more at the websites listed there

We have done some work in Louisiana and also in the Florida Everglades<sup>7</sup>, looking at what has caused the evolution of this landscape over time and what is the current situation there and the complex interactions between agriculture, urban and natural systems, and what the management policies and implications might be given that spatial context. If we go to the next slide, (not shown) this is a more recent application in the Patuxent Watersheds in Maryland and also the Gwynns Falls<sup>8</sup> Watershed in Baltimore. Looking at the interactions between the human and natural system components and ultimately being able to run scenarios for these systems.

In this case we are showing on the left a little series of eighteen different scenarios that we ran with this model that lead to varying kinds of land use and also what variations those cause in terms of nitrogen loading to the estuaries, the hydrologic behaviour of the system, the net primary production of the system and various other ecological and economic variables that are included in the model. Ultimately that allows us to evaluate those different scenarios in terms of the ecosystem services that are produced by each of those scenarios and being able to weigh that against other factors, other variables in the model system. We would like the landscapes in those scenarios to be ones that produce an optimal set of ecosystem services and that we include the value of those services in the assessment of the various scenarios.

I will finish up with some ideas about what do we do with this kind of information? How can we use the value of ecosystem services and natural capital to help get us to our goal, our vision of a more sustainable and more desirable future? In general, we can use these estimates to help make the market tell the truth. The market system currently leaves out, those things that are external to the market system. It leaves out the information about value of ecosystem services. How can we get that information into the system? Sometimes people jump to the conclusion that that means we should privatise these services and have private markets answer that question but I do not think that is the answer, largely because most of these ecosystem services are not private goods, they are public goods. So we do need to ingest market incentive to send the right signals to the market. It is not a case of simply privatising the services, but more of a case of sending the right signals and using economic incentives in a more sophisticated way perhaps.

Here are some examples of how that might occur. The first one is this idea of ecological tax reform. If we tax bads like this depletion of natural capital and ecosystem services rather than goods like labour and income, then we move some of the perverse subsidies that are already there that encourage the depletion of natural capital. Those taxes would filter through the rest of the system and lead to more appropriate phrases on all of the market goods than the ones that we have now. It would make the market tell a better approximation to the truth.

Of course in order to do that we would have to know how big those taxes should be, that is where the research on the value of those services really comes in. We can do a better job of full cost pricing in other ways. For example, there is a company in England called True Cost<sup>9</sup> and I have included the website on the slide that is trying to estimate the external environmental cost of companies operations and then posting that information using it for rankings of these companies. Investment fund managers can then choose which companies to invest in based on a quantitative estimate of their environmental performance and that will get the Board of Directors' attention if their stock prices start being affected by their environmental performance.

Another idea is of ecosystem service payments which are something that is being used in Costa Rica and considered elsewhere, where the Government plays the role of broker, linking the providers of ecosystem services with the beneficiaries. Currently they have four different ecosystem services that they are taking into account, including water supply, biodiversity, eco-tourism and one other.. For example, the water supply service; the Government collects fees from water users in urban areas and also hydro-electric dam operators and then collects those fees and then makes payments to landowners to conserve or reforest their land. It pays the producers of the service, the owners of the forested land, to continue the provision of that water supply service.

Conservation easements or concessions that Conservation International has been active in using are another idea. Instead of buying land outright, one can simply purchase the conservation easements, the requirements that the land be used in only certain approved ways. One could buy the logging concessions, for example, on the land and then not log. Of course in many of these kinds of applications uncertainty is fairly high, we do not know what the impacts are going to be. One might need to use something like environmental assurance bonds, which would be bonds paid by the polluters to incorporate this uncertainty and shift the burden of proof. The bonds could then be refunded when and if those damages were shown to be less than the worse case scenario, so that allows one to actually fold in the uncertainty cost into the system.

### **Lisbon Principles of Sustainable Governance:**

- 1. Responsibility Principle*
- 2. Scale-Matching Principle*
- 3. Precautionary Principle*
- 4. Adaptive Management Principle*
- 5. Full Cost Allocation Principle*
- 6. Participation Principle*

*From: Costanza, R. F. Andrade, P. Antunes, M. van den Belt, D. Boersma, D. F. Boesch, F. Catarino, S. Hanna, K. Limburg, B. Low, M. Molitor, G. Pereira, S. Rayner, R. Santos, J. Wilson, M. Young. 1998. Principles for sustainable governance of the oceans. Science 281:198-199.*

Here we begin to develop a set of principles that one could use to govern these kinds of complex systems more sustainably. If our goals are sustainable, high quality of life for humans and the rest of the biosphere, what sort of principles would we need to achieve those goals? This is from a workshop that we did several years ago and published in *Science* in 1998. We produced a list of six core principles that one would need to use and some of these may be familiar to you already.

The Responsibility Principle that the rights to use resources carry attendant responsibility and they should be, for example, the responsibility to use those resources sustainably.

The Scale Matching Principle implies that the scale of the human institution should match the scale of the ecological system that is being managed and it is not necessarily one institution that can manage systems over this multitude of scales that these ecosystems and their services occur. We need to be more cognisant of that scale matching requirement.

The Precautionary Principle simply means that we should reverse the burden of proof, that when public resources are at risk the burden of proof should be on the parties that stand to gain from that activity, not the parties that stand to lose from that activity. In general we should take a more precautionary stance toward using those resources.

The Adaptive Management Principle implies that we should learn from our policies, we should not assume that our policies are going to solve the problem but rather that they are experiments that we are performing with the system and we need to learn from those experiments.

The Full Cost Allocation Principle, I have already mentioned in terms of how we get the market to include, or get the system to include, all the cost of benefits and use economic incentives and full cost allocation to help us do that.

Finally and importantly, the Participation Principle, that to the extent possible, we should allow participation from all the stakeholders affected by these problems, at the earliest possible point, and all the way through the process.

To briefly recap the conclusions - the environment is not a luxury good; we need to get beyond this debate about the environment versus the economy. Ecosystem services contribute to human welfare and survival in innumerable ways both directly and indirectly and they represent probably the majority of economic value on the planet, but we have to get serious about evaluating, managing, understanding what those services are and how they support our welfare. Ecosystem services have been depleted and degraded by human actions to the point that the sustainability of the system is now threatened, making it even more serious to start looking at those systems. Restoring these damaged ecosystems is not a sacrifice that is a misperception in many people's minds - where we have to sacrifice something in order to restore these systems. In fact, it would increase the sustainable quality of life of people, so *it is a sacrifice not to restore these systems*.

A sustainable and desirable future is both possible and practical but first we have to create and communicate the vision of that world in compelling terms; the fact that that world would be a better world, it would be a higher quality of life place - it would not be a sacrifice, it would be a place that would be where we would all be happier. Thanks very much.

## QUESTIONS

These were not recorded.

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- <sup>5</sup> Costanza, R. & Ruth, M., 1998. Using dynamic modeling to scope environmental problems and build consensus, *Environment Management*, 183-195
- <sup>6</sup> Van den Belt, Marjan., *Mediated Modeling – A System Dynamics approach to environmental consensus building*,  
Costanza, R., *Landscape Simulation Modeling – A spatially explicit, dynamic approach*,
- <sup>7</sup> The Everglades Landscape Model, <http://www.sfwmd.gov/org/erd/esr/ELM.html>
- <sup>8</sup> The Patuxent and Gwynns Falls Watershed Models, <http://www.uvm.edu/giee/PLM>
- <sup>9</sup> True Cost, [www.trucost.org](http://www.trucost.org)

# **The Environmental Status and Problems Facing the Rotorua Lakes**

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## **ABSTRACT**

Water quality status of the Rotorua lakes may be examined from a number of different perspectives; through water clarity measurements or trophic level indices, which combine information on nutrients, phytoplankton concentrations and water clarity, and, for deeper lakes, depletion rates of dissolved oxygen in bottom waters in association with stratification. In addition, LakeSPI may be used as an indicator of health of benthic plant communities, specifically macrophytes. Together, these indices provide an indication of trends in water quality; many of the deep Rotorua lakes show a long-term (2-3 decadal) trend of declining dissolved oxygen in bottom waters which in several cases is corroborated by increases in Trophic Level Index and decline in LakeSPI values indicative of native macrophyte bed health.

It is important to use these measurements to forecast when there may be abrupt and sometimes catastrophic changes in lake water quality and biodiversity as a result of increased stresses imposed by additional nutrients and invasive species. The costs of restoration amplify greatly once lake degradation exceeds a 'tipping point', when the lake switches into a low-water clarity state often characterised by loss of weed beds in shallow lakes or increased blue-green algae (cyanobacteria) populations in deep lakes. Lake restoration is best achieved through nutrient retention on land, before the tipping point is reached and provided that there is sufficient time to arrest increases in catchment nutrient loads, as the costs of removing nutrients from the lakes themselves are substantially greater than the costs of their direct application to land.

*The following is the paper presented by Professor Hamilton and the words in Italics are taken from the transcript delivered at the Symposium and inserted where appropriate.*

## Introduction

*Thank you Bill and good morning. I wanted to thank first of all Don Stafford for a very interesting and insightful presentation this morning and it just made me feel quite humbled when we look at the history that has taken place before us and think of our role on the landscape. I put it into a 24 hour clock and if you look at when some of the problems in water quality issues first arose in the Rotorua lakes, it was in the 1950s. So in the 24 hour clock since the commencement of Lake Rotorua, that is about 30 seconds before midnight.*

*I have been here about three years and a lot of action plans have been developed over a clock that is ticking, now about 5 seconds to midnight. We are talking about a condensed timeframe in which we wanted to start to have impacts in terms of lake restoration.*

An important scientific paper by Scheffer et al. (2001) showed how natural ecosystems often respond in abrupt, sometimes catastrophic ways to prolonged stress. In aquatic ecosystems this stress may arise from increased nutrient inputs, invasive species (e.g. ‘oxygen weeds’), extreme weather events and/or water level changes. In shallow lakes subject to these stresses, two stable states may be identified (Scheffer, 1998). One state is a clear-water phase, with extensive weed (macrophyte) beds that reduce turbulence and increase stability of bottom sediments, and also compete with phytoplankton for available nutrients. The other state is characterised by low water clarity and severe reduction of macrophyte beds. Many of the Waikato peat lakes have remained in the latter stable state for several years or decades, whilst the ‘Wahine’ storm of 1968 uprooted macrophytes from Lake Ellesmere (Canterbury), switching this lake from a clear-water, macrophyte-dominated state to an apparently permanent low-water clarity state with very high levels of suspended sediment. While this transition across a ‘tipping point’ has not been so abrupt for Lake Rotorua, there were substantial decreases in both water clarity and invasive macrophyte beds through the 1970s.

Deep lakes are not widely recognised as having alternate stable states, but there are two readily recognisable states in the Rotorua lakes; those that have deep chlorophyll maxima (DCM) and very high water clarity in surface waters (e.g. Rotoma, Tarawera and Tikitapu), and those that have low water clarity, high surface chlorophyll concentrations and no recognisable deep chlorophyll maximum (e.g. Rotoiti, Okaro). The latter state is often characterised by blooms of cyanobacteria, while these blooms tend to be much less common in lakes with a DCM (Ryan, 2006). Changes in DCM populations (i.e. in species, biomass and depth) may provide an important early indicator of deterioration in water quality, and may be able to be used alongside changes in dissolved oxygen in bottom waters as an early signal of changes in lake trophic status. Trophic state indices are commonly used to make assessments about the productivity of a waterbody. No single indicator provides an exact quantitative assessment of trophic state because there are many interacting factors (e.g. mixing depth, grazing, temperature etc.) that influence productivity. Composite measures related to nutrients (e.g., total phosphorus) or light (e.g., Secchi disk depth) provide chemical or physical indicators, respectively, with which to assess trophic state, whilst biomass (with chlorophyll *a* as a typical surrogate) is a more direct indicator. These indices are often averaged spatially (e.g. across stations) or temporally (e.g. over seasons or years) to smooth some of the inherent natural variability in measurements and to provide a better indication of long-term trends. Trophic state indicators should not necessarily be equated to water quality, however, which tends to be a more subjective judgment often influenced by water use.

There has been a tendency to take three or four indicators and use them to derive a single numerical value, rather than to prioritise only one indicator or make comparisons between indicators. A single value is convenient in that it may be more readily interpreted and compared by non-specialists. The Trophic Level Index (TLI) assesses trophic state based on Secchi disk depth and concentrations of chlorophyll *a*, total phosphorus and total nitrogen (Burns et al., 1999). The use of total nitrogen in the TLI is an attempt to increase predictive power of this index, as phytoplankton communities in New Zealand have been found to be limited by nitrogen more frequently than those in the Northern Hemisphere. The TLI has been adopted for the New Zealand Lakes Water Quality Monitoring Programme, and is recommended for trophic level assessments by the Ministry for the Environment. The TLI is reported annually for Rotorua lakes that are monitored regularly (Environment Bay of Plenty, 2005). LakeSPI (Lake Submerged Plant Indicators) has been developed by NIWA to provide an indication of lake ecological health based on composition and abundance of weed beds (Clayton et al., 2002). SCUBA divers assess various aspects of the composition, distribution and cover of native and submerged weed beds to generate numerical values for native and invasive weed beds, as well as for overall lake condition. Data presented in the study below relate only to the native weed bed 'health'.

The main difficulty with any of the trophic state and lake health indices may arise when they are used outside of their intended bounds, i.e., in a predictive mode without detailed considerations of how lake ecosystems respond. As described above, lakes may behave in a highly non-linear way to an imposed stress (e.g. sudden loss of macrophyte beds or disappearance of the DCM). In addition there may be a strong hysteresis in the recovery path once the tipping point has been exceeded (Harris, 1999). In other words, it may be necessary to reduce the original stressor(s) substantially below levels prior to the tipping point, in order to successfully achieve restoration once the degraded stable state is attained. This of course has important implications for the costs of lake restoration. If a decline in lake health is arrested before the tipping point then it may often be achieved relatively cheaply. On the other hand the degraded stable state is often associated with generation of large internal loads of nutrients (i.e. from the bottom sediments), which are notoriously difficult and costly to reduce.

The recovery pathway for the Rotorua lakes is complicated by the lag between rainfall in the lake catchment and its input to the lakes, as a result of groundwater storage. The time scale on which the groundwater aquifer has become enriched with nitrate in response to conversions of indigenous scrub and forest to pastoral land, and with general intensification of agricultural land use, will mean that arrest of the increased nitrate loads will take some time. This lag time may be critical, particularly for lakes that are close to the tipping point and which may continue to decline despite active catchment management measures to control nutrient inputs to the lakes. For lakes that exceed the tipping point (i.e. those transformed to a degraded stable state), costs for restoration will be substantially elevated. The objective of the present study is to examine several of the Rotorua lakes from the point of view of stable state theory (Strehlow et al., 2005), in order to better understand and predict lake responses to management actions.



## Methods

Several different methods of assessing trends in water quality are used here. One of these measures is the volumetric hypolimnetic oxygen deficit (VHOD), which is a value assigned to the depletion rate of dissolved oxygen in the bottom waters (hypolimnion) of a lake over the period of thermal stratification, typically spring to autumn. There are several prerequisites that are important in accurately quantifying the VHOD (Burns, 1995), most of which were applicable to the lakes observed in this study though it is difficult to meet all of the prescribed prerequisites perfectly. The VHOD is considered by some (e.g. Hutchinson, 1938) to provide the most reliable time series indicator of changes in organic matter generation and trophic state within lakes.

Trophic Level Index (TLI) is derived as the mean value of the following four components:

$$TLp = 0.218 + 2.92 \log(TP)$$

$$TLn = -3.61 + 3.01 \log(TN)$$

$$TLs = 5.56 + 2.60 \log(1/SD - 1/40)$$

$$TLc = 2.22 + 2.54 \log(Chla)$$

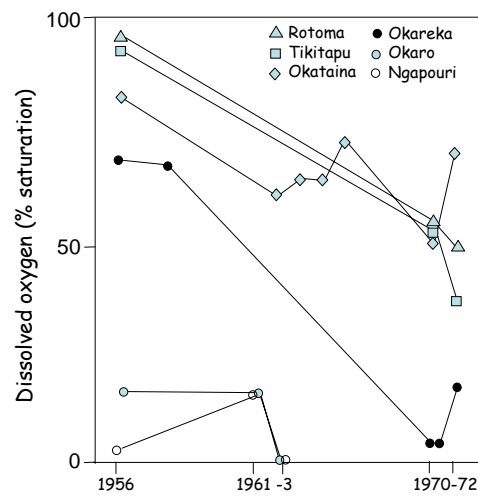
where TP, TN and Chla are concentrations of total phosphorus, total nitrogen and chlorophyll *a* ( $\text{g L}^{-1}$ ) respectively, and SD is Secchi disk visibility (m) and  $TLI = (TLp + TLn + TLs + TLc)/4$ . Values of TLI were taken from Environment Bay of Plenty (2005).

Frequency of phytoplankton blooms in Rotorua lakes may provide another indication of changes in lake health, as most blooms are associated with cyanobacteria species. Increases in relative composition of cyanobacteria, as well as their biomass amongst the phytoplankton assemblage, have been associated with deteriorating water quality and increased nutrient levels (Oliver and Ganf, 2002). Blooms, in particular, are often indicative of largely mono-specific phytoplankton assemblages with low biodiversity. In 2005, Environment Bay of Plenty included reporting of phytoplankton bloom frequency in its state of the environment reporting for the Rotorua lakes (Environment Bay of Plenty 2005). This information provides an additional indicator of changes in water quality. Depth distribution of phytoplankton communities may also be used to assess lake health and was used below to categorise deep lakes into those that presently exhibit a deep chlorophyll maximum and those where chlorophyll concentrations are greater in surface waters.

## Results

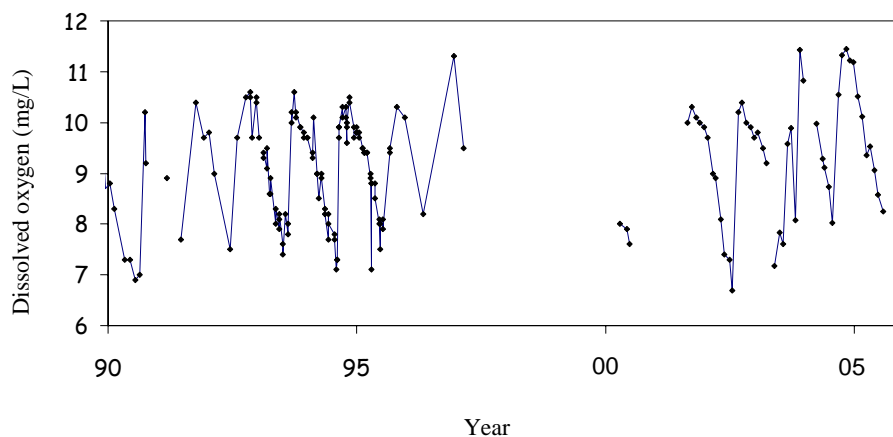
Figure 1 has been re-drawn from McColl (1973) and shows near-bottom oxygen levels relative to saturation, just prior to winter mixing in 6 lakes in the Rotorua region. It is now possible to extend the data set up to present; lakes Okaro and Ngapouri still have no oxygen, in lakes Tikitapu, Okataina and Okareka bottom waters are devoid of oxygen or nearly so, while in Lake Rotoma oxygen is still around 50% of saturation levels.

Figure 1. Levels of dissolved oxygen in bottom waters of 6 lakes at the end of the stratified period from 1955 to 1972. Re-drawn from McColl (1972).

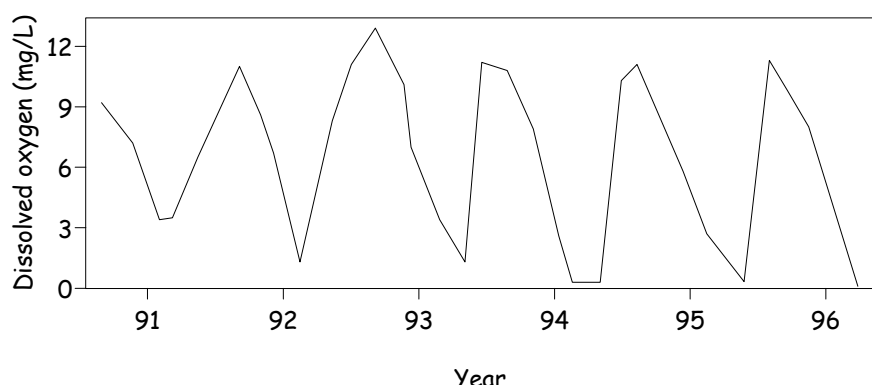


Figures 2 (*below*) and 3 (*next page*) show time series observations of dissolved oxygen in deep (hypolimnion) waters from Lake Tarawera and Lake Rotokakahi. Dissolved oxygen varies seasonally by around 3 to 4 mg L<sup>-1</sup> in Lake Tarawera. It also shows inter-annual variations and appears to have been very high in the past 2-3 years. Most importantly, there appears to have been very little change in the amplitude of the annual variations, suggesting that the lake is relatively stable in terms of productivity. By contrast, even with the relatively limited duration for which data are available for Lake Rotokakahi, there is strong evidence of greater depletion of dissolved oxygen in bottom waters. Note also how dissolved oxygen at the onset of winter, i.e. the annual peak concentration, is relatively stable, which suggests that the rate of depletion of oxygen has increased for the period corresponding to the period when the lake stratifies.

Figure 2. Dissolved oxygen concentrations in Lake Tarawera at depth 60m for the period 1981-2006 (data from Environment BOP lake monitoring programme).



*Figure 3.* Dissolved oxygen concentrations in Lake Rotokakahi at depth 25m for the period 1990-1996 (data from Environment BOP lake monitoring programme).

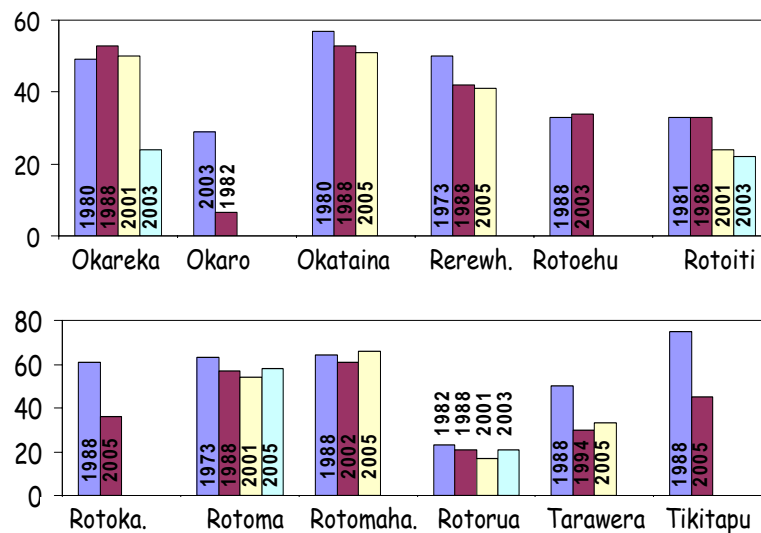


In Lake Rotoiti there is a well documented progression of increasing rates of oxygen depletion in the hypolimnion through many years. Vincent et al. (1984) captured this trend as an exponential increase through the period from 1956 to 1983, though recent data indicate that the oxygen depletion rate may have reached a plateau (Hamilton et al., in press). In an earlier volume of the Lakes Water Quality Society Symposium Proceedings, Hamilton (2004) pointed to other lakes where there was a trend of declining oxygen levels in the hypolimnion through time (e.g. lakes Tikitapu and Okareka), while it remains to be seen whether recent declines in hypolimnetic oxygen levels in Lake Okataina are a temporary phenomenon or part of a long-term trend.

The algal monitoring data presented by Environment Bay of Plenty (2005) indicates marked increases in bloom frequency, assessed relative to the recreational contact standard, in lakes Rotoiti and Rotoehu between the period 1997-2000 and 2000-2005. In Lake Rotorua, however, bloom frequency appears to be stable or has decreased slightly.

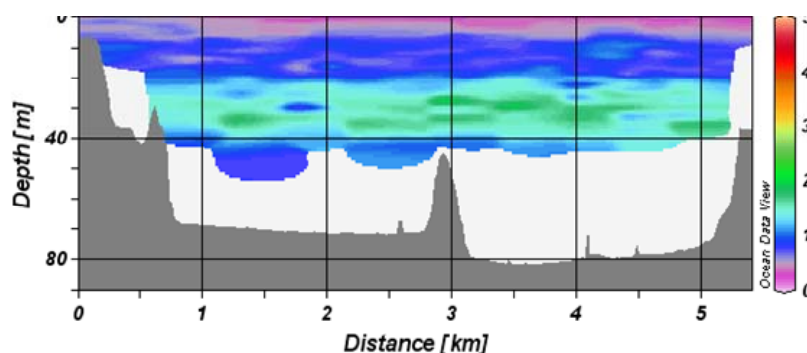
LakeSPI surveys have been collated intermittently over a period of more than 30 years in some of the Rotorua lakes. Figure 4 shows a histogram of the native index LakeSPI values for 12 of the lakes (see Environment Bay of Plenty, 2005). Obvious declines in LakeSPI native index values have occurred in 7 out of 8 lakes, while the 2005 value in Lake Tarawera is substantially lower than in 1988, but has increased slightly over the 1994 value. Interestingly, lakes where there is an obvious increase in rates of oxygen consumption in the hypolimnion (e.g. Rotoiti, Okareka, Tikitapu and Rotokakahi) all show large decreases in LakeSPI native index values. Lakes Rotorua, Rotoehu, Rotoma and Rotomahana have LakeSPI values that appear relatively stable, though only Rotoma and Rotomahana have values that exceed 50.

Figure 4. LakeSPI native index values for 12 Rotorua lakes at selected time intervals. Abbreviations: Rerewh. is Rerewhakaaitu, Rotoka. is Rotokakahi, Rotomaha. is Rotomahanua.



Another feature of some of the Rotorua lakes is the existence of a deep chlorophyll maximum (DCM) when deep lakes stratify. The DCM is a discrete horizontal layer of elevated concentrations of chlorophyll attributable to phytoplankton that have high capacity to utilise the available light deep within the water column. Figure 5 shows the position of the DCM in Lake Rotoma. Other lakes where there is a detailed record of a DCM include Tarawera and Tikitapu (Ryan 2006), but the DCM is certainly not confined only to these lakes. Lakes with a DCM have high water clarity (Secchi depths generally > 8 m), which is important in perpetuating the DCM. By contrast, in Lake Rotoiti there is currently no evidence of a DCM, water clarity is low, and the summer phytoplankton assemblage is dominated by cyanobacteria that are buoyant and can therefore to at least partially dissociate themselves from an inadequate light resource. In effect, therefore, cyanobacteria perpetuate their own existence with declining water clarity while non-buoyant competitors decline.

Figure 5. Cross-section (north-east to south-west) of chlorophyll fluorescence in Lake Rotoma, late summer. Numerical values on the colour scale approximate to chlorophyll a in  $\mu\text{g L}^{-1}$ .



## Discussion

Several indices have been used in this paper to denote long-term trends in water quality in the major Rotorua lakes. Across all of the water quality indices selected, only Lake Rotoma and, arguably, lakes Rotomahana and Rotorua appear to be stable. The remaining 9 lakes show a marked deterioration in at least one of the selected water quality indices.

Lakes do not respond in a systematic or linear way to a prolonged imposed stress, such as increasing nutrient concentrations. The response tends to be one of a long period of resilience, during which time there is gradual erosion of high biodiversity and nutrient processing capacity, followed by an abrupt adverse change. This response has been well documented for shallow lakes where it has been demonstrated repeatedly that there is a stable state of high water clarity associated with weed beds that both stabilise the bottom sediments and contribute to nutrient removal from the water column, and another stable state of low water clarity characterised by loss or absence of weed beds (Figure 6). The recovery pathway may be relatively independent of the pathway for degradation in that there may have to be reductions in the original pressure substantially below what occurred during the degradation phase, in order to begin to recover the original ecosystem.

The alternative stable state is not as well recognised for deep lakes, but may be equally as significant as for shallow lakes. In the deep Rotorua lakes that have low productivity, the existence of a deep chlorophyll maximum (DCM) appears to be the norm (Fig. 5). This layer owes its existence to high water clarity, but it may also play an important functional role in removing nutrients that would otherwise be transported into the surface mixed layer. Once water clarity is diminished sufficiently, e.g. as a result of increased nutrient inputs, the DCM disappears and there will be a new stable state of reduced water clarity associated with high concentrations of phytoplankton in the surface mixed layer of the lake (Fig. 7). This change may be closely linked with declining oxygen levels in the deep waters of the lake during stratification.

*Figure 6.* Schematic pathways of hypothetical degradation and restoration in a shallow lake.

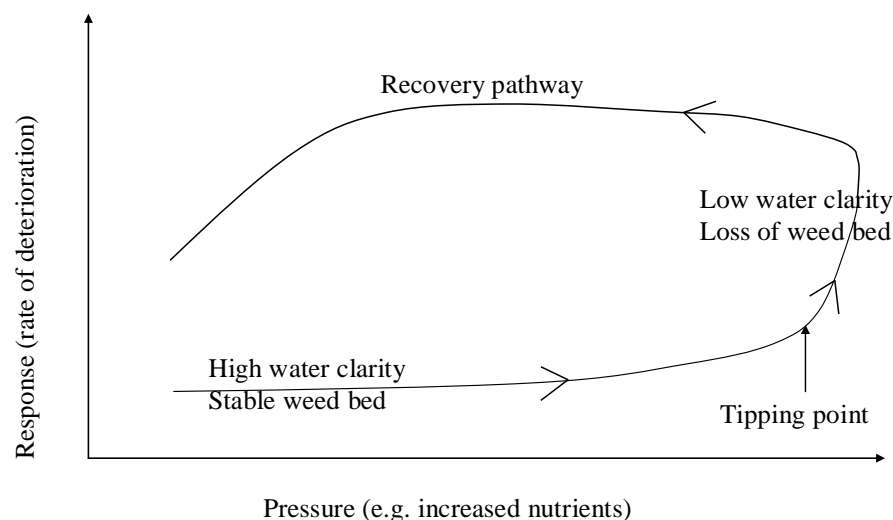
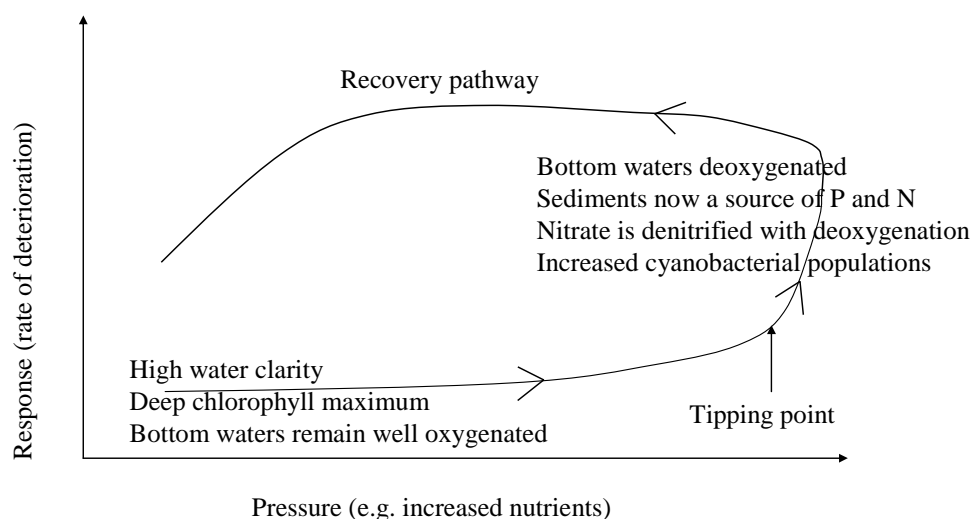


Figure 7. Schematic pathways of hypothetical degradation and restoration in a deep lake.



It is interesting to consider whereabouts some of the deep Rotorua lakes are in relation to the transformation pathways of Fig. 7. Lakes Tikitapu, Okareka and Rotokakahi may not have reached the 'tipping point', but show clear signs of degradation. Lakes Okaro and Rotoiti have clearly progressed beyond the tipping point and only costly restoration measures applied for a considerable period of time will restore the high-clarity state. More information is required on lakes Okataina and Rotomahana before these lakes can be categorised along the transformation pathway shown in Fig. 7, while lakes Tarawera and Rotoma appear to be stable and should be relatively resilient to degradation for some time.

The implications of Figures 6 and 7 to the management of lakes are fairly obvious; restoration is easier and costs will be much lower if action is taken to arrest degradation before the tipping point is reached. Once at the tipping point, much more severe and persistent management actions will be required, as well as relatively long durations, in order to restore the ecosystem. All of this is of course predicated upon the pathway of restoration ultimately being to attain some pre-existing state of water quality, though this is not guaranteed.

There may have to be quite severe management actions taken in the degraded lakes in order to achieve restoration. These actions may involve attempting to limit nutrient exports from the land, but may also include inflow diversions, flocculating and sedimenting out nutrients from the water column, dredging sediments or attempting to re-aerate bottom waters. Preliminary analyses indicate that the costs of these measures may be 1 to 2 orders of magnitude greater, in terms of mass of nutrients removed per dollar expended, than the costs of land-based applications of the nutrients in the form of fertiliser. This analysis serves to demonstrate the importance of retaining nutrients on the land and targeting lake restoration measures to arrest degradation before the tipping point characterised by rapid degradation.

*I want to digress a little bit to give you an illustration of one of these lakes which went through I guess what you would call a tipping point; a major degradation of water quality. This is Delavan Lake in Wisconsin, it is an area that is about one fifth of Lake Rotoiti, it had an \$11,000,000 restoration programme which was carried out during 1989 and the early 90s. I will just illustrate to you the major costs or what was involved in these costs. One of them*

*was an inlet extension and an extensive lake draw-down which was to create a new inlet for this lake. Some of the restoration was done before the science was what I would call fully mature and so I guess some of the costs that were incurred were not fully effective also. Rotenone is a fish poison that was applied to attempt to manipulate and change the food chain and also in response to some of the invasive fish species that had got in. Huge amounts of Rotenone were applied, some estimate 50% of the world's market, and the US Army got involved, so this was a pretty major programme. Also an alum application, 146 tonnes of alum was applied to obtain a concentration of 2.5mg/litre of aluminium. So major costs were incurred in this restoration once the lake had got past that tipping point.*

## **Increasing Value of Nutrients Between Application and Removal**

### **Applications - fertiliser**

Urea @ 46% N	\$ 500/tonne	c. \$ 0.92/kg N
Superphosphate @ 9 % P	\$ 186/tonne	c. \$ 2.06/kg P

### **Removal of nutrients**

- Ohau Channel diversion wall		
\$180 tonnes N p.a. @ 20 years		c. \$3.89/kg N
\$ 15 tonnes P p.a. @ 20 years		c. \$46.70/kg P
- Hamurana diversion		
\$67 tonnes N p.a. @ 20 years		c. \$10.53/kg N
\$ 8.3 tonnes P p.a. @ 20 years		c. \$46.70/kg P
- Flocculation		
\$2000/tonne PhosLock = 10 kg P		c. \$200/kg P
- Oxygenation		
\$5m capital + 1.8m p.a. operating @ 20 years		c. \$41/kg N
		c. \$102.50/kg P

*I thought at this point it is interesting to have a look at what sort of value we might attribute to nutrients and I suppose it is an early foray for me as a non-economist into some of the economics that are involved, but we could look at it in terms of our application and I thought we would have a look at some of the fertiliser applications. Urea at 46% nitrogen by weight, about \$500 per ton. It is comparatively cheap still to provide nutrients to these systems; we are looking at about nearly a dollar a kilo for nitrogen and \$2 a kilo for phosphorus. Now these nutrients start to attain real value, they take on real value if you can export them off your land, as for example in milk production, or in meat in terms of farming. They also have a lot more value once they actually get into the systems and waterways in particular, which really serves to re-emphasise the fact that what you want is them on the land and not in waterways. So let's just have a very quick look at the costs involved.*

*Let's assume the Ohau Channel diversion wall was effective over say twenty years and was pulling out 180 tonnes of nitrogen and 15 tonnes of phosphorus per year. So in that case we are looking at nearly \$4 a kilo for nitrogen and maybe nearly \$50 a kilo for phosphorus - substantially more than what it costs to actually apply these nutrients onto the land. The Hamurana diversion is another consideration that is on the table at the moment and that would pull out about 67 tonnes per annum of nitrogen and 8.3 tonnes of phosphorus per year,*

and that would equate to the figures on the right-hand side there. The costs of flocculation, and flocculation is a chemical process by which you may add material in order to attempt to flocculate out some of the phosphorus that is already in the water column and also to protect the bottom sediments of lakes – and that may be, for example \$2,000 per ton of Phoslock pulling out about 10kg of phosphorus, about \$200 per kilo. Here is the cost of oxygenation, estimated \$5,000,000 capital, about \$1.8 million per annum operating (these are very rough figures), but just to give an indication of the costs involved. Now, this is purely on a per nutrient basis. I want to emphasise that it does not take consideration of the impacts within the lake itself and that is where a lot of the modelling starts to obtain real importance, that you can not just look at these figures and say these are purely on a per weight basis because it is also the effects that these have in terms of their water quality.

For example, David Berger's work in the modelling has shown that it depends a lot on time of year when these nutrients are applied. The bottom sediments become relatively more important than inputs from the catchment at certain times of year, corresponding in this case to summer when a lot of the release events happened in Lake Rotorua. This brings me to the role of modelling and understanding these tipping points and also the impacts of nutrient removal and what has been worked through with the stakeholders group and Environment Bay of Plenty and others as to what some of the options are. There will also be some costs associated with these options and how these can be brought into a modelling strategy which is currently being applied. And the modelling strategy extends to all of the catchment, it is being done through a combined programme with IGNS, NIWA and Environment Bay of Plenty. The modelling then links up with the different catchment options for the lake itself to look at the impacts on the lake.

So here's some of the changes that we may see; a long-term trend of increasing groundwater nitrate concentrations, various options here that were put in to the model to look at what the potential impacts are. I think it has to be said that the modelling has pretty useful in understanding some of the dynamics of the Ohau Channel diversion.

In this very initial foray into looking at some of the economics and we thought that we would follow on from some of the overseas studies which have linked lake water clarity to property values around lakes. And so I want to thank Brentleigh Bond for encouraging me to do this through ratings from the Rotorua District Council looking at a 500 metre buffer strip around the lakes and looking at how land values have changed in response to that. What we attempted was to have a look at how certain lakes had responded in terms of percentage increase in their ratings over a 3 year period, basically from 3 years previous up to current and looking at the increase in land value and the increase in capital value corresponding to those. Essentially we could not find any relationship with water clarity and water quality in particular, but I want to emphasise it is very preliminary and we are just simply using some ratings exercises.

Just to summarise, trend indicators are fairly well tried and tested but can we extend these to a better understanding of tipping points, I believe that we can. The modelling will tell us more about these tipping points and so also will running scenarios that ultimately will integrate some of the environmental, economic and social factors surrounding the lakes, and I think a more comprehensive analysis of nutrient costs would be useful, including the outputs



*from farm production to integrate this into an overall perspective of what value do we assign to nutrients which are essentially driving these lake systems.*

## ACKNOWLEDGEMENTS

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## QUESTIONS

There were questions but technical difficulties prevented a transcript

# **The Rotorua Lakes Protection and Restoration Action Programme, Proposals, Costs, Progress**

Paul Dell, *Environment Bay of Plenty – Lakes Project Coordinator*

John McIntosh, *Environment Bay of Plenty – Manager Environmental Investigations*

## **Presenter – Paul Dell**

*Paul Dell is Group Manager of Regulation & Resource Management for Environment Bay of Plenty. He is the project coordinator for the Rotorua Lakes Protection and Restoration Action Programme. He has worked in the environmental management field for 27 years particularly focusing on environmental protection. He has been instrumental in the development of catchment management plans in the Waikato and the Bay of Plenty.*

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## **ABSTRACT**

Since the adoption of the “Strategy for the Lakes of the Rotorua District” in late 2002, significant progress has been achieved in developing the Rotorua Lakes Protection and Restoration Action Programme but particularly implementation of the Programme.

In the early stages major effort was required to establish the research programmes and communicate the problem and the programme to the wider community. The establishment of the Environment Bay of Plenty Chair in Lakes Management and Restoration at the University of Waikato in late 2001 was an important strategic action that today is paying major dividend to the project.

This paper outlines:

- The problem and cause of declining water quality
- The Rotorua Lakes Protection and Restoration Action Programme
- Identified actions and preliminary costs
- Progress on the various actions
- Funding outline.

While the estimated price tag of \$190 million is significant it must be put into context with respect to the value that the District, Region and Nation’s population put on these Lakes.

*Included in this presentation in Italics are Paul’s comments taken from his transcript*

## **1 Background**

Since the development of the “Strategy for the Lakes of the Rotorua District” in 2002 by Environment Bay of Plenty, Rotorua District Council and Te Arawa Maori Trust Board there has been a major commitment by all parties, including the wider community to move forward in protecting and restoring Lake Water Quality.

This paper outlines:

- The problem and cause of declining water quality
- The Rotorua Lakes Protection and Restoration Action Programme
- Identified actions and preliminary costs
- Progress on the various actions
- Funding outline

## 2 The Problem and Cause

In its simplest form the degraded water quality of a number of the Rotorua Lakes is shown by the formation of blue-green algal blooms (*Figure 1*), and the associated health warnings that are placed on parts of or whole Lakes at different times.

*Figure 1* – Blue Green Algal Bloom – Lake Rotoiti



From a scientific viewpoint the decline in water quality is shown much earlier by the measurement of reduced oxygen levels in the bottom of the Lake which can last for many months in the deeper Lakes. Many of the Lakes are showing declining water quality.

Table 1 shows the water quality objective for each Lake as a TLI (Trophic Level Index) and the current quality. The TLI combines clarity, chlorophyll a, Nitrogen and Phosphorus levels into a single number. The higher the number, the poorer the water quality.

Table 1: Lake Water Quality Status – 2005

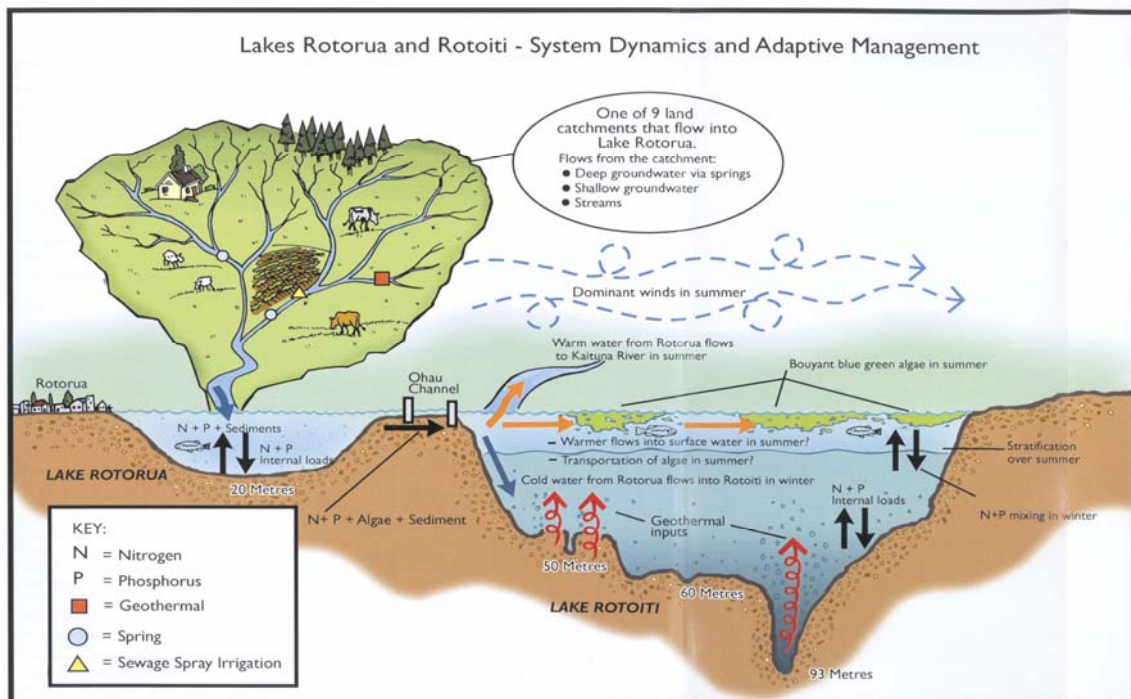
Lake	TLI in Objective 10	Current TLI (at 2005)	Lake Type based on Trophic Level
Okaro	5.0	5.6	Supertrophic (very sick)
Rotorua	4.2	5.0	Eutrophic (sick)
Rotoehu	3.9	4.6	Eutrophic (sick)
Rotoiti	3.5	4.5	Eutrophic (sick)
Rotomahana	3.9	3.8	Mesotrophic (stable/unstable)
Rerewhakaaitu	3.6	3.4	Mesotrophic (stable/unstable)
Okareka	3.0	3.3	Mesotrophic (stable/unstable)
Rotokakahi	3.3	3.3*	Mesotrophic (stable/unstable)
Tikitapu	2.7	3.2	Oligotrophic (healthy)
Okataina	2.6	3.0	Oligotrophic (healthy)
Tarawera	2.7	2.9	Oligotrophic (healthy)
Rotoma	2.3	2.5	Oligotrophic (healthy)
Taupo		2.2	Oligotrophic (healthy)

\*2001 estimate

The cause of the declining water quality is simply “Too much Nutrient” (Nitrogen and Phosphorus) getting into the Lakes, building up in the sediments and creating a cycle of de-oxygenation, nutrient release and blue-green algal blooms which when they die back contribute to oxygen uptake in the bottom of the Lake (*Figure 2- Hamilton 2003*).

Figure 2: General Lake Nutrient Dynamics

Appendix 3



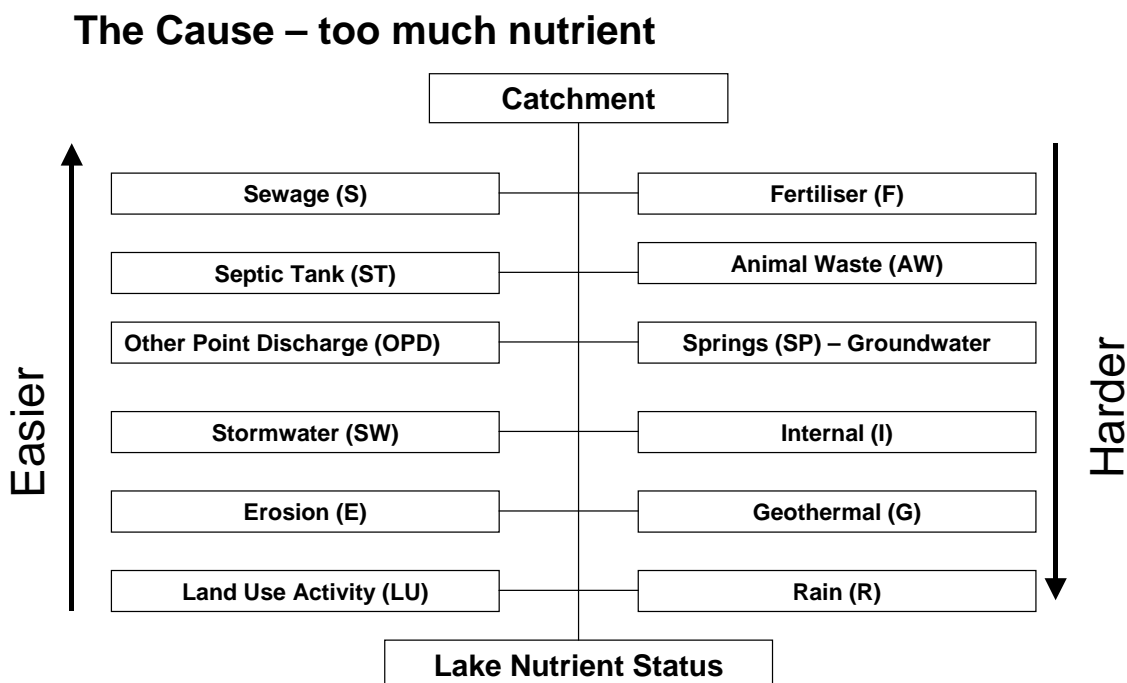
*Environment Bay of Plenty (EBOP) have set objectives for water quality through the Water and Land Plan which is a statutory document. Through this document we can now determine how we are going to move from where the Tropic levels are now to where they should be, or in a number of higher quality lakes such as Rotoma, how we are going to keep them in such condition and not let them slip. It is no accident that the top lakes in table 1 are in that rich green colour. Okaro, Rotorua, Rotoehu and Rotoiti, and Okareka have been our first sweet of catchments where we have started developing action plans.*

*In 2002/03 there was a huge decline in the water quality of Rotoiti and even this morning, while Rotorua's algal blooms warnings have been lifted, we have a wider warning on Rotoiti. There are continual dynamics going on within these lakes. I think it is fair to say that while we talk scientific numbers, the reality is the green lakes are very sick or sick, and we need to get on and address this.*

*Of course the cause is too much nutrient. If we live or recreate or visit a catchment, one way or another we will influence the nutrients that get into these lakes. The reality is, if we look at the economics on the global scene, if we consume products that come out of this catchment, we are also linked in some way to what is happening.*

There are numerous sources of nutrients, some easier to manage than others (Figure 3). While some of the sources are natural in a number of Lakes we have now reached such high levels that we need to look at all sources and various options to reduce the nutrient load.

Figure 3: Nutrient Sources



The following briefly outlines each of the sources:

### ***Sewage***

A reticulated sewerage system can reduce the effects of human sewage nutrients to a low level. In the controlled treatment of sewage nitrogen and phosphorus can be targeted for reduction. Phosphorus is separated out in the sludge as is some of the nitrogen. Some nitrogen can be converted to nitrogen gas and discharged to the atmosphere.

*A lot has happened historically in sewage treatment in Rotorua. In 1991 a new plant was commissioned, a \$32,000,000 upgrade which was a major step for both Central Government and the community to do. Today we have a sewerage plant that would certainly be at the forefront of New Zealand engineering and science. There have been some hiccups along the way but the reality is what used to be 150 tonnes of nitrogen and 30 tonnes of phosphorus going into the lake is now about 28 tonnes of nitrogen and 1 ton of phosphorus. There has been major benefit from that huge upgrade.*

### ***Septic Tank Effluent***

In the discharge field excess nitrogen is converted to nitrate which is mobile and tends to leach. Dissolved phosphorus may be absorbed by clay minerals in the soil but this capacity can be overwhelmed leading to phosphorus leaching to groundwater and hence to streams or lake.

*Wherever you go in the world lake communities put in money and effort to reticulate. It is knowing deep down in your heart that this is an ongoing cost and it has to be done, not just now but for the future.*

### ***Other Point Discharges***

Any other consented discharge not covered.

*These are regulated through the consent process and we do not see them as major issues.*

### ***Stormwater***

Rainwater discharge from urban areas washes off a vast array of material into waterways. Nitrogen and phosphorus make up a portion of this load and may be predominantly in the particulate form. NIWA have characterised the stormwater nutrient discharge from Rotorua city.

**Rotorua has done a lot of work in this area. Peter Dine, RDC, has been leading that work to clean up and reduce the amount of nutrients coming in from that system.**

### ***Erosion***

Soil erosion in the landscape and stream bank erosion along stream channels carries particulate materials into the lake. Nutrients attached to particles may not be immediately available for plants and algal growth. In time this nutrient load would become buried in deposits at the stream mouth or be processed and released as soluble nutrient.

*Rotorua used to have a major erosion of the pumice material getting into the lakes, which included in it phosphorus. But there has been a lot of positive work, such as the upper Kaituna Catchment Control Scheme.*

### ***Land Use Activity***

Human activity on the land surface influences the processing of nutrients in the soil zone and the eventual fate of the nutrients. Forestry land use is conservative with respect to nutrients, with a lot of recycling and low loss. Pastoral farming introduces the additional nutrient processor – the grazing animal. With more rapid re-cycling of nutrients loss of nutrients below the root zone is promoted. The urine spot becomes a zone of high nitrogen loss to the underlying groundwater mainly in the form of nitrate nitrogen.

### ***Fertiliser***

Nutrients are added to land to stimulate plant growth in agricultural or horticultural systems and also for urban purposes. These can be washed off the land or leached through the land to groundwater and then to streams or the lake. Sometimes there can be direct application to waterways with prior application methods. Phosphorus transport to waterways is usually associated with overland flow as volcanic soils contain phosphorus-absorbing clay minerals which retard leaching. Nitrogen is more susceptible to leaching especially when in the nitrate form.

### ***Animal Waste***

Animals distribute urine and dung unevenly across the landscape. Particulate and dissolved material may be washed off in overland flow with rain events. Riparian strips can effectively intercept this source. Dissolved nutrients can be leached to ground water and then to streams or lakes. Animal urine is a major source of nitrate for leaching into groundwater.

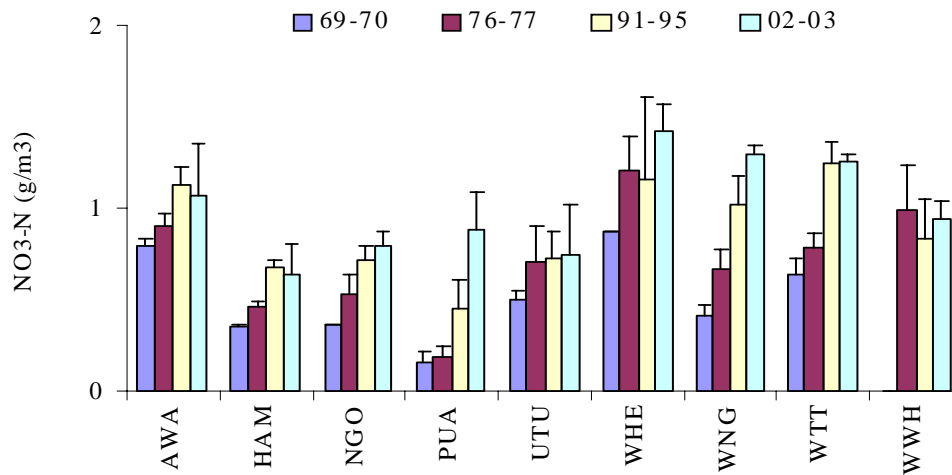
### ***Springs***

In the Rotorua catchment groundwater emerges in the lower catchments as springs. These form the source of the streams flowing into the lake or enter the streams along their course. They are also a major source of dissolved nutrients. Phosphorus is dissolved out of the underlying volcanic geology.

Nitrogen in the springs is predominantly in the nitrate form and is derived from land use activity. Nitrogen is increasing over time in these streams (Figure 4).



Figure 4: Base flow Nitrate at Major Sites



*Some of the springs have groundwater 135 years old which takes a bit of thinking about what this actually means in this project. Therefore our project is one of depth of management. We can not just focus on land use, although that must clearly be an important part, but if we want to see some rapid changes we are going to have to do some big things, such as the Ohau diversion and possibly Hamurana and other options. Otherwise a lot of money will be spent, we might wait fifty or sixty years for changes and there has to be a balance between what people will be willing to contribute for what they will see in their lifetime.*

### **Internal**

Sediments in the bottom of lakes are sinks for nutrients. There may be exchange at the sediment surface between the water and the sediment, but when the water is well oxygenated there is a net loss of nutrients to the sediment. When lakes stratify, dead algal cells and other organic material falling into the bottom waters depletes the oxygen due to the decomposition process. No replenishment of oxygen is possible from the atmosphere. As the bottom waters run out of oxygen the chemistry of the sediment surface is changed and nitrogen and phosphorus are released from the sediment into the water. The nutrients are trapped in the bottom water until the lake mixes vertically. With a flush of nutrients algal production is enhanced if other environmental or climatic factors favour this after mixing.

*The internal load is a big issue for many of our Rotorua Lakes. The sediment is full of nutrients and David Hamilton has been instrumental in this research.*

### **Geothermal**

Geothermal fluid does not necessarily contain nutrients. The nutrient content depends on the material it passes through as it moves from the geothermal source to the discharge point. In the Tikitere/Rotoiti area, geothermal fluid has a characteristically high ammonium-nitrogen content. Other areas may have elevated phosphorus levels.

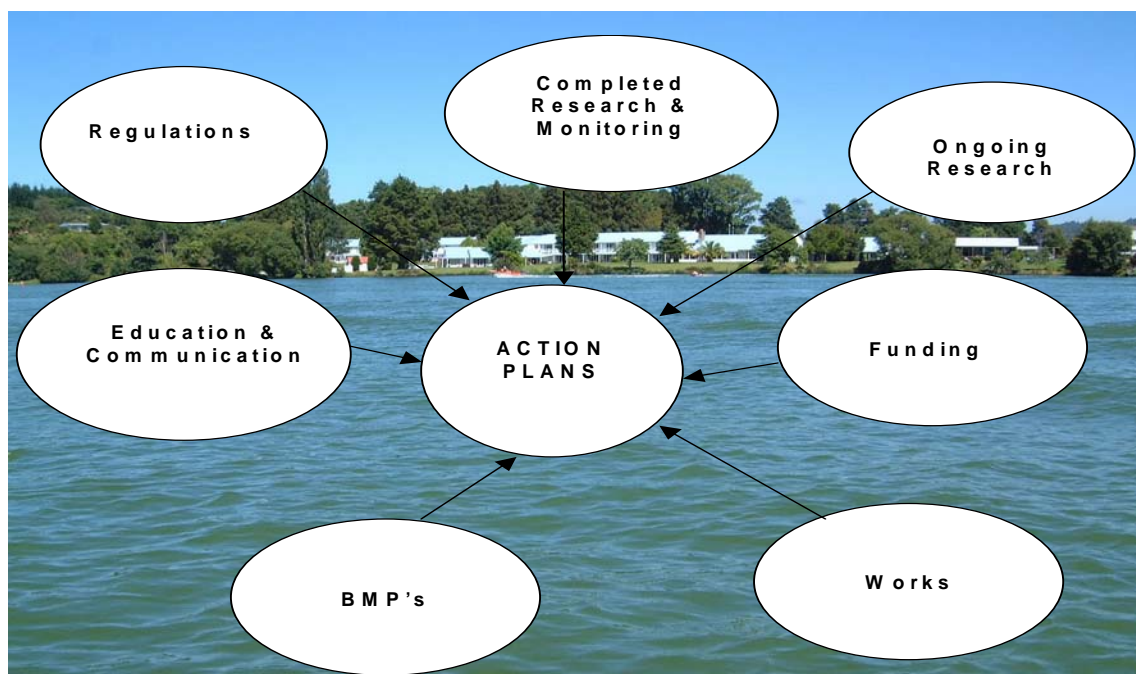
### **Rain**

Rain carries a load of nitrogen and phosphorus due to the deposition of airborne material and dissolution of gaseous material.



*Dr Bruce Hamilton came from Australia really to run the ruler over the overall project. We were pleased when he left saying that basically we had things under control and were doing a good job and had picked up on what was important. His diagram above shows the holistic picture, looking at the catchment, the lakes and between the lakes. Rotorua is not really the downfall of Rotoiti. The arrows show the release of nutrients out of the sediments which is going to be the big challenge for this programme. We now know in hindsight that while a lot of excellent work went into sewage reticulation we were all hopeful that it would bring about the long-term restoration of Lake Rotorua and its flow on into Rotoiti. We did not see this increasing signal of nitrogen coming through the groundwater. You can see that for all of the major inflows, the signal is pretty strong in most of the catchments. Where the signal is weaker, or levelled off, it is probably because of very little development going on in that particular catchment. There is a huge study of groundwater going on so we can try and get an understanding of sources, so then we can look at where the best place to put our money.*

Figure 6: Rotorua Lakes Action Plan Work Modules



The following is a brief outline of the various elements.

#### *Completed Research and Monitoring*

This element identifies information that improves the understanding of processes in the catchments and lakes that in turn will lead to viable management options. It includes not only research and monitoring on the Rotorua lakes but research from other lake catchments such as Taupo that can be applied to this programme. A detailed Bibliography on Rotorua Lakes Water Quality Research was prepared in 2003 (Miller).

### *Ongoing Research and Monitoring*

This is targeted to understanding key processes and ongoing changes in lake quality. The work is focussed on both the catchment and the lake and will be used to identify options and support long-term management. This work will also assess changes in nutrient load brought about by different actions. This includes establishment of The Chair in Lakes Management and Restoration at the University of Waikato, student support, water quality monitoring, modelling, and various research.

### *Funding*

The funding work involves economic assessments to assist in evaluating the costs of implementing specific options. It is particularly important in considering land use change options. This work will assist negotiation with government on funding by the local authorities and in reviewing their own funding policies. Different economic funding tools will also be evaluated. Both Councils will present the funding proposals through their LTCCPs.

### *Works*

Identifying works that can be implemented to achieve both short and long-term improvements is essential to the programme. A number of urgent actions will be dependent on certain works. This can include constructed wetlands, sewage treatment, diversions, flocculation, changes in land uses, riparian management.

*Some of the works already have involved sewage upgrade of the city plant which has already started to show a positive outcome in terms of the reduction in the nutrients going up into the forest irrigation. We see reticulation around Mourea and Okawa Bay and the application of the Ohau Consent for Diversion underway, and although under appeal we are very positive that we will get through that.*

### *Best Management Practices (BMPs)*

Identifying BMPs - to reduce or eliminate nutrient inputs from the various land uses and practices in the catchment and their application by landowners and managers are important tools. This can include feed pads, fertiliser regimes, nitrification inhibitors, S/W management, and effluent management.

*This is where we have to take a little more time because the science has to catch up. This is going to be a big driver in changing the way we farm the land. There have been huge mixed messages out there for the farming community and we are hopeful that we can step in and work with the farming representatives to help their own members. The farmer, I believe, is willing to make changes but they want to have a reasonable certainty of doing the right thing. We have a major role in this area and a lot of research is going on funded by Government and other agencies.*

## Education and Communication

This is essential to keep the community informed and appropriately involved in the various processes. This includes newsletters, fact sheets, website, Lakes education resource kit, presentations, local press articles, field days, working party meetings.

## Regulations

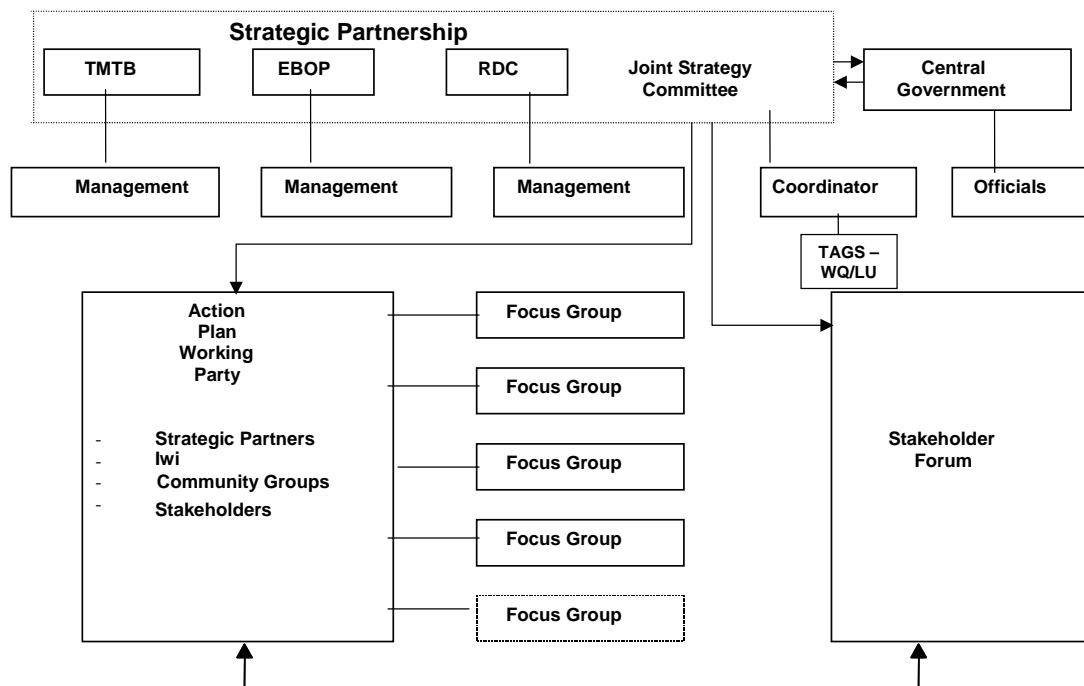
As part of the “toolbox” regulations will be necessary to underpin gains made, give certainty and protect investment decisions. At present there are operative nutrient capping rules, stock exclusion from waterways rules, Variation 12, On-Site effluent treatment rules.

*People do not like them but regulations have to be an important part if there is going to be millions of dollars in investment. We have to protect that investment and so Rule 11, which is saying we must stop any further nutrients coming off the land into the lake, has had to be put on the table. I congratulate the farming community; while they have not necessarily said they are happy, they have stood up and said “we will agree to this while we work through the bigger programme”. There has already been an economic hit for that sector in the community, as for people in the residential area who live next to lakes who have the blooms. So everyone is being affected in different ways.*

## Action Plan

The Action Plan is the centre-point of the programme and will set out the communities agreed options to achieve the long-term water quality goals. All the other elements support the development and implementation of the Action Plan. A strong implementation framework is in place to ensure the Strategy and Restoration Programme is achieved (Figure 7).

Figure 7: Governance & Implementation Framework



*I think the strength of this programme has been the very strong governance overview from day one and this shows up in the top of the diagram with the three strategic partners of Environment Bay of Plenty, Rotorua District Council and Te Arawa Maori Trust Board. They are the Joint Strategy Committee. They are able to cut right across any internal organisational issues and keep this project moving. I have to say from where I sit as the coordinator, it is very positive and for me there have not been barriers.*

*I would also like to highlight the tag groups underneath – there is a water quality tag and a land use tag. In the water quality tag we have a whole lot of scientists from all round New Zealand, about ten of them, people such as Professor Hamilton, Professor Warwick Silvester, Dr Kit Rutherford, Max Gibbs, Dr Julie Hall, Dr Clive Howard-Williams, people from SCION and they trawl through every piece of work to make sure that it is solid so that by the time we take it out to the community, we hope that we have really made sure that we are taking good science. Within that forum, we do get down to some very good debate and things do change.*

*Land use has been a new one we have put together and again, there are a lot of experts from throughout New Zealand. What we are trying to do is get them to focus on what other tools are necessary to bring about land use change or land use management change and that is an area where we certainly have a lot of work to do.*

*But it is really this Action Plan Working Party, empowering the community through the process. We have the Action Plan Working Party involved, representatives from the community, iwi, stakeholders, the councils – and their job is to roll up their sleeves and get down and say we have a problem, how are we going to solve it, let's recommend it and again, this is where we get buy-in. Off that group we have focus groups that often go away and really dig down into some of the detail of sewerage reticulation or Ohau Channel diversion of flocculants. I have to say the process to me has been a very positive one; it is about community being part of decision making. Every three to four months we hold a stakeholder forum where anyone in the community can come along and talk to us about the lakes. So we think that we do have engagement.*

*So what is the role of this Action Plan? Really it is to define the existing catchment nutrient budget and again, Professor Costanza talked about this – you need to know what is happening in the catchment in the watershed to determine what level of nutrient input is sustainable. So what can we do long-term? Let's not just make a bit of knee-jerk, let's try and nail this down; identify our targets, determine actions to achieve those targets and this is where I am pleased we do take a holistic approach to planning, we learnt this through the first one we did on Lake Okareka, you must recognise the wider implications - sewerage, landscape, climate change and economics. I think now that we have all of these components coming into the process and, as I have said reaching agreement and understanding of the science along the way is certainly very positive.*

*In the majority of the lake catchments the major actions will be identified and documented in the Proposed Action Plan that will then be formally released for wider community consultation. However in the case of Lakes Rotorua and Rotoiti a number of urgent actions are being evaluated and will be actioned before the full integrated Plan is developed.*

While the focus of the Action Plan is on protecting or restoring lake water quality it should be viewed as an integrated vision of sustainable development within a catchment. There are linkages from the Action Plan to the two Council statutory planning documents which will require many different environmental aspects to be evaluated when considering different actions. An example of this is the need to consider landscape values when evaluating land use change options.

The process also recognises that as a result of an agreed Action Plan, changes may be required to the various statutory planning documents.

With respect to nutrient management the key role of the Action Plan is to:

- Define existing catchment nutrient budget (*Table 2*)
- Determine what level of nutrient inputs is sustainable
- Identify nutrient reduction targets (*Figure 8*)
- Determine actions to achieve targets
- Reach agreement/understanding of the science

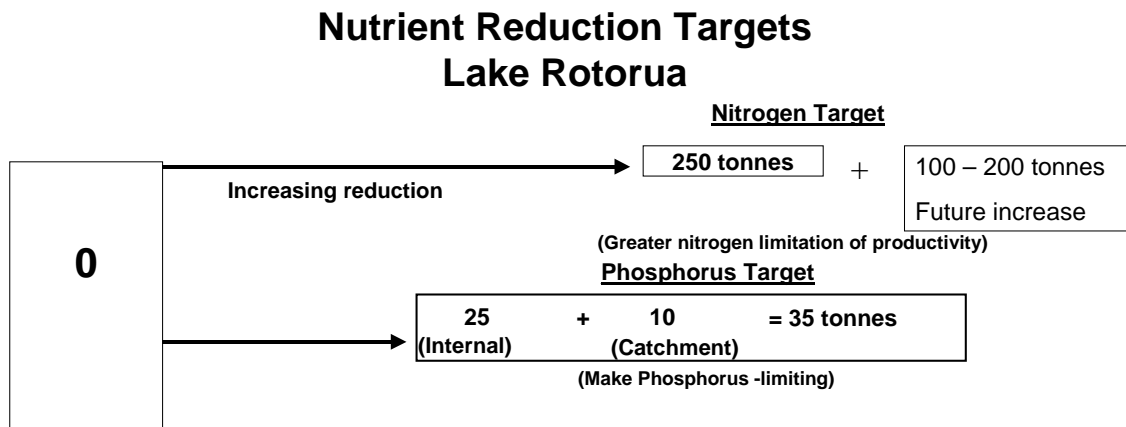
*Table 2:* Example of a Lake Nutrient Budget

<b>October-04 Nutrient Budget Lake Rotorua</b>			
<b>Land use</b>	<b>Area</b>	<b>Load</b>	
	<b>ha</b>	<b>N</b>	<b>P</b>
		<b>tonnes/yr</b>	
Native Forest & scrub	10588	42	1.3
Exotic Forest	9463	28	1.0
Cropping + hort	282	17	0.6
Pasture	<b>20112</b>	<b>573</b>	<b>18.1</b>
lifestyle	556	11	0.5
Urban	3267	50	3.8
Springs			13.0
Geothermal		42	1.4
	44268		
<b>Total Catchment Inflows</b>		<b>763</b>	<b>39.7</b>
Rain		32	1.2
Internal		<b>308</b>	<b>24.0</b>
Lake	8079		
<b>Total</b>	<b>52347</b>	<b>1103</b>	<b>64.9</b>
Wildfowl (recycling)		1.43	1.37

Note: The phosphorus in springs is derived from the underlying geology and is not accounted for as a land use factor, whereas the nitrogen component is included as a land use output and appears in the other parts of the budget.



Figure 8: Initial Reduction Targets – Lake Rotorua



Above (in Table 2) is the example of a nutrient budget for the Rotorua catchment. We have spent a lot of work on this, a lot has been measured in detail and we are doing some further modelling and actually at this very time a number of the team are sitting down to refine this in the light of some recent groundwater aging work we have done. We are trying to get a real long-term handle, not just today, not 50 years, but 200 years out – where is nitrogen and phosphorus going to be in the Rotorua catchment, so that when we do make our decisions they will be solid. You can see that at the moment certainly pastoral farming is a major source of inputs from the catchment to the lake but within the lake itself those sediments are a major problem. The difference we see here is it is not just about the catchment change which clearly is important for future, but I come back to if we want to see relatively quick improvements, we are going to have to get into some fairly interesting solutions and options.

#### 4 Identified Actions & Preliminary Costs

The actions that can be implemented will vary from catchment to catchment dependent on the source nutrients and environmental-economic-knowledge and community constraints.

The following (Table 3) outlines the actual possible type of actions that have been identified with preliminary costing for each catchment either through the Action Paper process or by an overview evaluation of possible options.



Table 3: Estimated Costs – Lakes Protection & Restoration Actions

Lake	EBOP Action	Estimated Cost \$M	RDC Action	Estimated Cost \$M
<b>Rotorua</b>	Hamurana Diversion	12.0	Upgrade sewage Plant New Reticulation Stormwater	3.5
	Tikitere Options	2.5-5.0		27.3
	P – Locking (10 Years)	11.5		1.0
	Sed Capping/mod Wetlands	24.0		
	Land Use	2.0		
		10.0		
		<b>\$62.0-64.5</b>		<b>\$31.8</b>
<b>Rotoiti</b>	Ohau Diversion	14.0	New Reticulation	27.5
	Sed Capping	5.0		
	Okawa Bay ?	2.0		
		<b>\$21.0</b>		<b>\$27.5</b>
<b>Okareka &amp; Tikitapu</b>	Flocculants (10 years)	0.3	New Reticulation (includes Lake Tikitapu)	10.2
	Land Use	1.0		
		<b>\$1.3</b>		<b>\$10.2</b>
<b>Okaro</b>	Wetland	0.5		
	Flocculants	0.2		
	Riparian	0.1		
	Sediments	0.2		
		<b>\$1.0</b>		
<b>Rotoehu</b>	Wetlands	1.2		
	Treatment “P & N”	0.6		
	Land Use	1.0		
		<b>\$2.8</b>		
<b>Tarawera</b>	Land Use	1.0	New Reticulation	13.75
		<b>\$1.0</b>		<b>\$13.75</b>
<b>Rotoma</b>	Land Use	0.4	New Reticulation	10.75
		<b>\$0.4</b>		<b>\$10.75</b>
<b>Rerewhakaaitu</b>	Treatment “P & N” Land Use	0.4		
		1.0		
		<b>\$1.4</b>		
<b>Others – Rotomahana Okataina Rotokakahi</b>	Flocculants	?		
	Land Use	?		
		<b>?</b>		
<b>Total</b>				

*So what do we see to put this in context for Rotorua? We initially said to the community two years ago that we have to get rid of 250 tonnes of nitrogen out of the catchment and now with our most recent work we think that it could be anywhere between another 100 to 200 tonnes on top of that and we are now finalising that. In terms of phosphorus, about 35 tonnes.*

*In our programme, we look at every option that we can put in place. In terms of what I would call the adaptive management, what we are doing within the lake catchments from a regional perspective is a programme in the vicinity of about \$90,000,000 and for the Rotorua District Council in the order of about 95 to 100 million for its sewerage reticulation and stormwater. We have had to look at a whole lot of options and think outside the square and we have had great community support. Some solutions have come from the community and some of them will stand the test of time. Others may not for different reasons. At the end of the day if we have to get resource consents, while the science may be solid, there are other issues and not everything is palatable to the community. But if their decisions is not to want it, we are going to have to accept that. Like your doctor, I can tell you what to do but if you do not follow my orders and you drop dead tomorrow, then I can not be held responsible. This is one of the things as a coordinator that I do say to people.*

*So what have we achieved to date? This is an opportunity to say to people that we actually have achieved a lot and while there may not be as much concrete poured around the place as some may like, a lot has been going on. Professor Hamilton introduced you to the Lake Delavan, (Wisconsin) work in America – they did not do a good job – they rushed in, spent a lot of money and David will tell you they really got no benefit whatsoever and the army of corps engineers have probably gone off and they are currently probably destroying another nice environment. But we can not afford to spend that sort of money and not get it right and that is why we have structure to this programme.*

## **5 Progress on Various Actions**

The following outlines progress that has been achieved in the various areas of the overall programme as outlined in Section 3.

### **5.1 Research & Monitoring**

- Established Lakes Chair (UOW) – 2002

*We see the Lakes Chair as an important component. Environment Bay of Plenty and Lakes Water Quality came up with this at a symposium many years ago and Environment Bay of Plenty said we will make this happen. We are hopeful eventually to see a Lakes Research Centre, a centre of excellence based around Waikato. We think it would pay huge dividends to this programme.*

- Established Lake (2003) and Land-Use (2004) TAG's

*These land use and lake tags are very critical to this programme.*

- Coordinated major research programme involving NIWA, GNS, SCION, UOW, URS, and others.
- Established international linkages
- MfE commissioned Review – 2003 – *This review confirmed to us that we were going along the right way.*
- Reviewed Lake Monitoring Programme

- Report Water Quality on all Lakes annually – *We report every year on lake water quality and people start to ring up about October asking where the annual report is and our website is well used.*
- Comprehensive Algal Monitoring Programme - *We have a comprehensive algal monitoring programme and continually refining it.*
- Major focus on flocculants and sediment capping- *There is not much of this work anywhere else in the world so we are doing this as green field work. We are trialling some products at the moment.*
- Developing complex in-Lake models. *David Hamilton's team are developing complex in-lake models. At the same time we are developing some very complex catchment models with people like Paul White from IGNS on groundwater and Dr Kit Rutherford of NIWA on catchment change*
- Deploying continuous monitoring “chains” in specific Lakes – *to measure oxygen, temperature, fluorescence and other things. Check our website.*

## 5.2 Regulations & Policy

- Lakes Strategy adopted 2002
- Proposed Water and Land Plan released 2002
- Nutrient capping rules/benchmarking, operative
- Exclusion of stock rules
- Set water quality objectives for each Lake
- On-Site Effluent Treatment Plan reviewed 2005
- Commenced development of integrated Management Strategy for Kaituna River/Maketu Estuary.
- Developed Lake Recreation Strategy
- Developing Lake Aquatic Pest Strategy

## 5.3 Works

- Major upgrade to City Sewerage Plant completed - 2005
- Mourea/Okawa Bay Community Scheme – 2006
- Detailed programme of reticulation for various communities around lakes prepared
- Ongoing catchment work – riparian, fencing
- Full review of riparian work undertaken – 2003
- Granted consent – Ohau Diversion (Appeals) – 2005
- Researching Hamurana Diversion
- Researching Tikitere options
- Constructing dosing plants for “P” locking – (Rotorua)
- Review of stormwater management undertaken
- Undertaken Phoslock application – Lake Okareka (2005 – 2006)
- Constructed Lake Okaro Wetland (2005)
- Constructed trial treatment boxes
- Assessing land-use change options – bush settlement

#### 5.4 **BMPs**

- Evaluating use of feed pads, feed lots, etc
- Evaluated use of nitrification inhibitors – ongoing assessment
- Reviewing fertiliser regime options
- Supporting the RLLT work programme
- Developed nutrient load assessment model (NPLAS)

#### 5.5 **Education & Communication**

- Established comprehensive Lakes web page
- Developed fact sheets on various issues/actions
- Regularly present to community/stakeholder group
- Hold Stakeholders forums annually (3)
- Established Lakes Education Teachers Resource
- Print regular articles
- Run regular radio updates
- Meetings of working parties & focus groups

#### 5.6 **Funding**

- Commissioned economic evaluations
- Commissioned a review to support funding
- Developed a comprehensive costing of actions
- Engaging with government on cost sharing
- Both Councils developing rating policy in LTCCPs

#### 5.7 **Action Plans**

- Lake Okareka – operative
- Lake Okaro – operative
- Lake Rotoehu – draft mid 2006
- Lakes Rotorua and Rotoiti – draft late 2006
- Focussing on urgent actions – Rotorua/Rotoiti
- Prioritised next Lakes for Action Plans – Rotorua, Tarawera, Okataina, Tikitapu

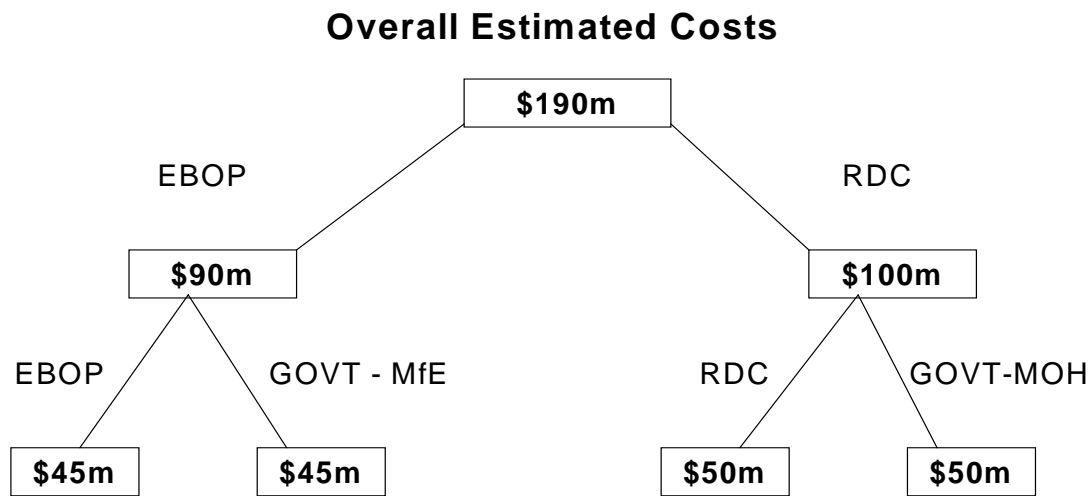
### 6 **Funding Outline**

Environment Bay of Plenty and Rotorua District Council have developed an overall estimate for the Lakes Protection and Restoration Action Programme of \$190 million. *Figure 9* shows a preliminary split of costs and the indicative cost sharing approach that is being made to government.

The following (Table 4) details the current draft overall cost programme for the actions being proposed by Environment Bay of Plenty showing the indicative actions on an annual basis from 2007 to 2016. To fund these works Environment Bay of Plenty is proposing to raise a \$45 million loan to be repaid over 20 years.

It will be noted that separate to the various actions there is ongoing funding of research and monitoring. The financial model has the research and monitoring decreasing over the next 10 years, while the loan repayments increase. The overall effect is a requirement to fund \$5 million per year for the Lakes Project.

Figure 9: Preliminary Split of Costs



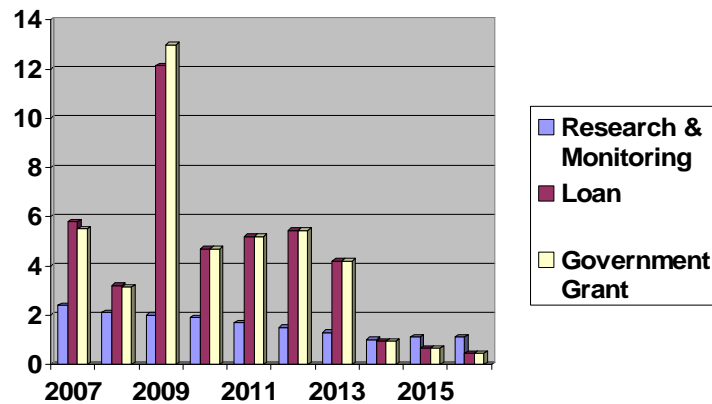
- Doesn't include loan servicing
- Doesn't include operational research = \$1.5 – \$2.0m per year

**Table 4 – Summary of Lakes Expenditure and Funding**

Year end	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	(\$million)	(\$million)	(\$million)	(\$million)	(\$million)	(\$million)	(\$million)	(\$million)	(\$million)	(\$million)
<b>Expenditure</b>										
Diversion wall	10.00	4.00								
Phos-locking	0.20	0.50	1.00	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Wetlands	1.00		0.50	0.50	0.50	0.50				
Tikitere channelling			0.50	0.50	0.50	0.50	0.50			
Hamurana diversion				6.00	6.00					
Capping sediments			20.00			2.00	3.00			
Flocculants	0.10	0.10				5.00	2.00			
P/N treatment		0.25	0.65							
land use		1.50	2.50	1.50	2.50	2.00	2.00	1.00		
Other									0.40	
	<b>11.30</b>	<b>6.35</b>	<b>25.15</b>	<b>9.40</b>	<b>10.40</b>	<b>10.90</b>	<b>8.40</b>	<b>1.90</b>	<b>1.30</b>	<b>0.90</b>
<b>Funding</b>										
Loan	(5.80)	(3.20)	(12.15)	(4.70)	(5.20)	(5.45)	(4.20)	(0.95)	(0.65)	(0.45)
Govt grant	(5.50)	(3.15)	(13.00)	(4.70)	(5.20)	(5.45)	(4.20)	(0.95)	(0.65)	(0.45)
	<b>(11.30)</b>	<b>(6.35)</b>	<b>(25.15)</b>	<b>(9.40)</b>	<b>(10.40)</b>	<b>(10.90)</b>	<b>(8.40)</b>	<b>(1.90)</b>	<b>(1.30)</b>	<b>(0.90)</b>
<b>Research &amp; monitoring</b>	2.4	2.1	2.0	1.9	1.7	1.5	1.3	1.0	1.1	1.1
<b>Summary</b>										
Cumulative Capex	11.30	17.65	42.80	52.20	62.60	73.50	81.90	83.80	85.10	86.00
Cumulative Loan	(5.80)	(9.00)	(21.15)	(25.85)	(31.05)	(36.50)	(40.70)	(41.65)	(42.30)	(42.75)
Cumulative Govt grant	(5.50)	(8.65)	(21.65)	(26.35)	(31.55)	(37.00)	(41.20)	(42.15)	(42.80)	(43.25)
Cumulative Research & monitoring	2.4	4.50	6.50	8.40	10.10	11.60	12.90	13.90	15.00	16.10

## Lakes Expenditure and Funding

2007 - 2016



*In conclusion what you have above in blue is the ongoing research and monitoring programme over the next ten years and you will see it is still having to run at a reasonable level but it will decline over time. If that declines, there will be increasing needs to service the cost of the loan to actually get out and do things, so there has been a very purposeful scaling back of the research as we get into the doing. Overall we are looking in the order of \$5,000,000 per year and that is certainly over a twenty year period. Most of the programme's expenditure will be in the first ten years because that is where we want to really make the difference. Some of the big costs are the Ohau diversion, the Hamurana diversion and then when we get in and cap or modify the sediments to stop the big releases, there is a very large investment in about 2009/2010.*

*We show the crimson purple colour with the yellow as being hopefully a sort of agreement we can reach with central Government for sharing the costs and that really will be the challenge before us because if we do not get the support of Government, I am sure the question will be "well, what are we going to do?" You will see later from the targeted rate presentation from our Chairman, without Government support there would be a huge burden which is already large on this community. We really do need to get Government to tell us where they are going to help with this programme. Thank you.*

## QUESTIONS

*Sally Brock, Lake Rotoiti Ratepayers & Residents Association: Is there a cost in there for land use change because you have got the structure for Hamurana and the Ohau Channel diversion but I did not see a specific cost set aside for that?*

*Paul Dell:* Yes there is. We have estimated \$10,000,000 in what we call land use change, land use management. At the moment because this programme has been having to get into some fairly major capital expenditure for a depth of management, we have long-term hope that we will be able to drive the changes in land use by purely economic benefits of putting in bush settlements; some of the crater lake type proposals. So our focus really is to try and use as much of our money in the front end to bring about rapid changes to try and get these lakes stabilised as soon as possible and then because of the old age groundwater, work through land use change but do that more by hopefully putting an economic environment that will bring about that change, instead of just having to take out the cheque book.

*Gerard Hogan, Royal Society:* A point of clarification Paul, that total cost of \$190 million, does it include the ongoing costs of maintaining those systems and how will that be shared and does it include the direct costs to property owners and farmers of perhaps, say, connecting to the sewage, etc.?

*Paul Dell:* I can certainly speak from the major Environment Bay of Plenty side of work, the ten year programme includes the capital operating costs. For example, we talk of putting in our phosphorus locking systems, we run that for ten years because our long-term programme is hopefully we will run the engine down in the lake and we will not have to run those systems forever, while other systems such as land use start to kick in and take over. So we have certainly funded in a lot of the operational. It is not so much capital as a loan to do a whole lot of operational and capital work. From the district perspective, I believe that there is still an individual connection fee and I am sure the Mayor will be able to touch on that tomorrow, separate from their overall cost of schemes.

*Warren Webber – Lake Rotoiti:* It would appear from previous presentations that I have heard from you that there is a far more dynamic understanding of the catchments in various areas, particularly the Mamaku Plateau. For many of us I think we struggle to understand why we get the differences between Rotoma and Rotoehu. Why is a seemingly protected lake like Okataina running into problems? Is there the same dynamic understanding of the water flow between the lakes and is there anything that might help us understand those things?

*Paul Dell:* Yes. We are doing a lot of our groundwater work to really understand some of those dynamics. One of the early ones was in fact Rerewhakaitu, very heavily developed pastoral catchment but the lake has been fairly stable, and we find that about one third of the catchment flow goes to Rotomahana. Lake Rerewhakaitu is perched, so it only actually sees a third of the catchment's inflow and the other third heads off to the river systems of Rangatiki. We are trying to understand the linkages and certainly have to with Rotoehu. We are doing water balance work, so that we can make sure that we look at not just a catchment but also if there are inter-catchment issues and how we take those into account. But it is quite complex because what is going on under the ground is not always easy. We think we have done enough work to give us a sufficient picture to say well this lake is having a major influence on this other lake or it is only a minor influence – and that is probably where we are getting to.

*John Roper – Lake Okareka:* I just want to ask a question about your nutrient capping. As a member of the Lake Okareka Management Action Plan Committee, I am rapt with what is going on out there but the one concern I do have is around nutrient capping and the



community is spending some \$10,000,000 this year on the sewage reticulation but the fertiliser planes have been pretty active flying the catchment as well. The specific question is, those measurements of nutrient capping and the amount of fertiliser going on, are they a matter of public record; can we access those in any way?

*Paul Dell:* You will appreciate, John, that we are the first region to bring in actual operative nutrient management rules and there has been sensitivity from landowners. This is a major change for New Zealand and so Council has made it quite clear that the information we get specifically will be confidential to those landowners but in terms of the big picture and not identifying individual properties, we will be giving an overview of what has actually happened in a catchment. If we say to farmers all your information is going on the website and everyone is going to see it, the fact is they will close up the doors and we will get nowhere. So there has to be a recognition that the Regional Council will work with those landowners. We have a role but we must recognise the sensitivities about this, because if we do not all we will do is create a really aggressive situation which will not benefit any of us. So my view is that we are making good progress, we are getting cooperation but I do not think that there is any need for their specific property details to be in the public arena. The bigger picture will clearly be in the public arena.

*John Roper:* Since we are all talking about catchments and catchments of individual lakes, then are catchment records available for the individual lakes?

*Paul Dell:* We have done a detailed nutrient budget for every catchment and we have put those out on the table from day one. That is information we have shared and there has been no argument about that at all, John.

*John Green – LWQS:* Regarding the farms around the lakes do you have a scale on which you rate them as more at risk to polluting the lakes or less at risk? In other words, are you going to look at various farms and say well those ones will seriously affect the lakes in the short-term and currently, as opposed to some which may be further away or having different land uses?

*Paul Dell:* Yes that is very much the focus of the groundwater work by GNS and we know already from his perched groundwater versus the deeper groundwater scenario and we presented this to the last working party meeting, John. We want to make sure that the changes we made are going to give us the best return in the quickest time possible. So from that groundwater work, we will hope that that will tell us where we should be focusing our energies and that is why at the moment Council has been quite clear that we do not want to rush around buying properties, making changes, until we get a good handle on exactly where we will get the best benefit for that energy that we put in.

*Lindsay Brighthouse, Lake Rotoiti:* Twice a year we see a plane pass over the other side of State Highway 33, it does ten passes and it drops half a ton of fertiliser each time. Now that happens at least twice a year, and we should really pick up on John's point, I just wonder if changed land use options is getting a high enough priority in the very critical points, for example, planes over Okareka, Te Wheta Bay and Rotoiti and around Rerewhakaitu too. Is it not something that perhaps should be brought a little bit forward to bring in something, Rule

11 may do it, to stop this heavy fertilizing on areas where the fertiliser just virtually goes straight into the lake.

*Paul Dell:* Thanks Lindsay. This issue of aerial spreading has been something we have been discussing with the industry sector for some time. They have been doing a review of their new Code of Practice and Environment Bay of Plenty have a project right now to review and in fact, with our Water and Land Plan if there is a linkage necessary, to look at this big issue. I think it will happen, they are already talking to those involved in Lake Okareka, and people recognise there will have to be changes to how this is being done. I want to be careful that we do not fight too many battles all at once and drag ourselves down, but it is on our radar and I think we are moving quickly on that issue Lindsay, so you will see things this year.

*Nick Miller – LWQS:* Following on some of these previous questions, just last week I watched fertiliser drifting down into the Lake Rotoiti catchment and I watched this happen at Easter time and Labour Weekend. Does Environment Bay of Plenty have accurate records open to public inspection as to how much fertiliser is being applied into the catchment of each particular lake per annum, taken from actual records of the aviation, etc?

*Paul Dell:* I think first of all, Nick, through our benchmarking progress we will be able to get a good picture and quite detailed in terms of a catchment lake by lake basis, but we have been seeking information from the main companies who supply material, so we are looking at that. But if we step back from that and say that at the end of the day, we want to be careful that we have to address the issue clearly if there is a visible impact of fertiliser getting into the lake, no argument. But we also have to recognise from the work from MAF that rushing headlong into attacking fertiliser when animal waste is making up about 90% of the nutrient loss and fertiliser 10%, that we need to make sure we keep our energies focused on long-term what is going to make a difference. That is what we are trying to pull together, keep the big picture. But clearly you are right – we do have to look at the overall issue of fertiliser, but remember the fertiliser predominantly is there to grow grass for the animals and it is the animals that have been driving the huge nitrogen loss into our lakes. So, again, we are trying to make sure that we are keeping that big overview.

*Bill Cleghorn, Session Chair:* Many of you in the room will be aware of the amount of work and time that Paul puts into his job and the successes that he is achieving with his team. What you may not know is that the work of Professor David Hamilton and his team and Paul Dell and his team has recently been subjected to some international criticism and critique. The result of that has shown that the work that is being done on the Rotorua lakes is amongst the best in the world. So you can be proud of the achievements that are being done on your behalf. I also would like to advise you that at the opening of the Lake Okaro walkway on World Wetlands Day, it was announced by Waikato University that it has bestowed the Waikato Medal for 2006 to Mr Paul Dell. Ladies and gentlemen, please thank Paul for his address.

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## **Restoring the Rotorua Lakes; The Ultimate Endurance Event**

Dr J. Morgan Williams

*Parliamentary Commissioner for the Environment*

*Morgan has been nine years as Commissioner focusing his team on environmental sustainability in urban, marine, energy, water, farming, economic and governance contexts. He is also an Adjunct Professor at the Universities of Canterbury and Queensland, and an Honorary Senior Lecturer at the University of Auckland.*

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### **ABSTRACT**

The Millennium Ecosystem Assessment released in 2005 was a major initiative by the United Nations and others to assess the health of the world's natural capital. It identified nutrient pollution of ecosystems as one of the biggest new environmental threats:

*“Human activities now produce more biologically usable nitrogen than is produced by all natural processes combined, and more than half of all the manufactured nitrogen fertilizer (first produced in 1913) ever used on the planet has been applied since 1985.”*

*“The flow of nitrogen to the oceans has doubled since 1960.” “The use of phosphorus fertilizers and the rate of phosphorus accumulation in agricultural soils both increased nearly threefold between 1860 and 1990.”<sup>1</sup>*

So, nitrogen and phosphorus are rapidly building up in the world’s soils and being lost to surface and ground waters with all the attendant consequences. Most of these losses are from agricultural activities.

Our Rotorua Lakes’ story is thus a microcosm of what is going on globally. We know that agricultural land use in the Rotorua basin accounts for 75% of the nitrogen, and 46% of the phosphorus entering the lake. This in turn delivers 60% of Rotoiti’s nitrogen input, and 51% of its phosphorus.

The other important, and now well documented, part of the science story is how long the nutrients take to get from land to lake waters. One recent study<sup>2</sup> found eight out of 12 spring and groundwater well samples had a mean residence time of 60 years – meaning that the effects of recent land use intensification are still many years away from impacting on lake water quality. The reality, now widely acknowledged, is that water quality will continue to get worse for some decades to come.

This has, of course, led to the current major effort being invested in protecting, and hopefully restoring, the lakes. As I say in my soon-to-be- released Rotorua Lakes scoping study,<sup>3</sup> “it is superb”.

In an endeavour to contribute to this effort I will discuss a number of elements, beyond immediate scientific and financial ones, that are essential if the desired water qualities are to be achieved and maintained within the next 40 –50 years. They can be summarised under the following three headings.

- Climate change, the biggest challenge overlaying all lake restoration efforts as well as our entire society
- The need for flexibility in land use and a ‘level playing field’ in policy, planning and tax regimes to ensure we build resilience into our land uses, and
- Institutions that will provide the enduring platforms for what will be a long and sometimes tough transition.

Ultimately it will be the institutional arrangements – through the enduring groups of people in the community - that will be the key determinant of successfully restoring the lakes to full health. These arrangements will need to be deeply embedded in the lakes’ community, well nurtured and widely supported if they are to sustain the needed effort for at least the next 40 years.

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<sup>1</sup> Living Beyond Our Means; Natural Assets and Human Well-Being. Statement from the Board, Millennium Ecosystem Assessment. Page No. 20, March 2005

<sup>2</sup> IGNS 2004, Groundwater age, time trends in water chemistry, and future nutrient loading in the Lakes Rotorua and Okareka area. Client Report 2004/17 IGNS

<sup>3</sup> PCE 2006, Rotorua Lakes Scoping Report. In Press

This duration of effort, which will be played out against the enormous challenges of a rapidly changing climate, will require the 'baton' to be passed through several generations – a Herculean task but one the Rotorua Lakes community has already shown it has the potential to take on.

*This presentation was backed by excellent slides. We have included them or extracted the quotes where possible.*

## TRANSCRIPT

Thank you for the kind welcome from Te Arawa this morning, I appreciate that as a South Islander. I actually was not too comfortable with a slot straight after lunch and you know why, because you have all got a nutrient overload problem. What I have got to try and do is make sure that that's not depleting your oxygen supply in the bottom of your lake and hopefully we can all stay awake.

My title gives you a little clue about one of the things that I want to focus on. It is the duration of the event and my title picture is not just there for a pretty picture, it is actually to link us to the globe in what we are doing. How we deal with these big thorny inter-generational tough problems is tied up in a favourite quote of mine of Albert Einstein's and I am sure you have seen it before –

*"The kind of thinking that got us into this situation  
is not the kind of thinking that will get us out of it"*

and that is what is going on. I also want to elaborate on the fact that we are facing a time in civilisation, it is that big, where we have got to weight the future more and discount the past. What I mean by that – we have such a turbulent time coming in front of us that we have got to be more future focused and rely less on our histories.

I want to make one thing absolutely clear: that the effort that is going on here, as we have seen this morning, is absolutely stunning and I have said that in a report we are releasing shortly. It is by any standard a superb effort.

I want to run through three parts:-

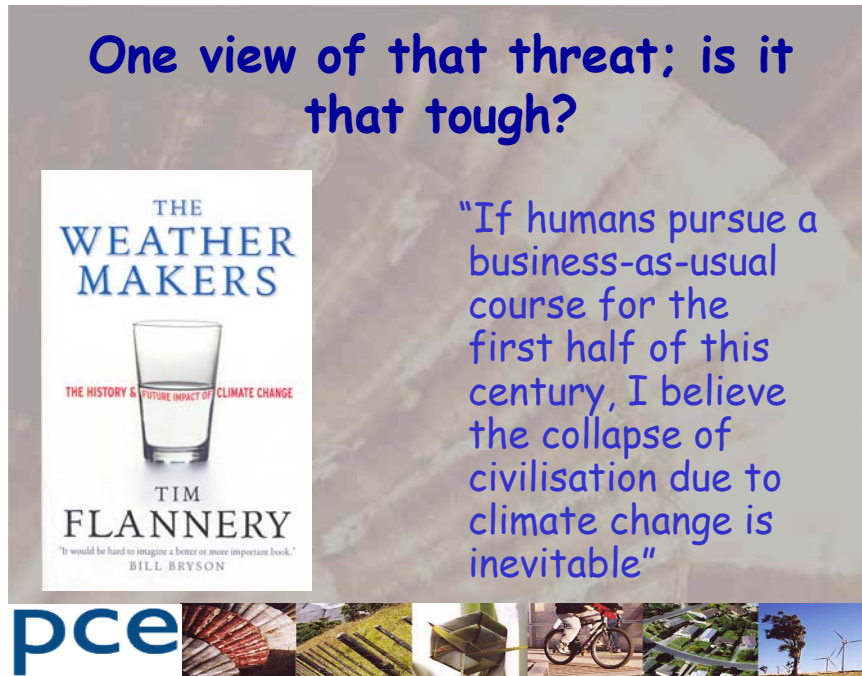
- **Context;** climate change, the mega challenge, and global ecosystem health consequences
- **Future proofing the lakes;** land use flexibility, level playing fields
- **Staying the distance;** enduring community institutions to maintain the effort to restore lake health over decades & generations

The context picks up quite a lot of what Robert Costanza said this morning, and I did not collude with him at all, but I have got some of the same slides. Let's stand back a little and look at something like a hurricane called Katrina. I really do not think we can focus too much on the rough ride, the tough changes that are going on, but I think we are coasting on climate change in New Zealand. I was in Europe last year, talking to people in Germany, the Netherlands and UK where there is a much deeper focus on climate change and its effect on business. Government circles have a much higher level of focus.

*"Climate change is a more serious threat than global terrorism"*

- Sir David King, 2003, UK Chief Scientist

That statement sums it up; we are being diverted by some of the things we are doing.



This is one view of the threat and if you have not read this book, buy it today or tomorrow and read it. It is one of the best assemblages of the climate change story in the most readable form, very well referenced, that I have ever seen. It makes it so clear that we are racing, literally racing against time if we are going to secure the sort of life that we have had for our kids and even for anybody here under 50, who are in for a rough time.

In case there was any doubt about it, my wife and I through February, clipped stuff that came into journals that we have in our house, the newspaper, *New Scientist*, the *Listener*, *Time* – and this is a series of clippings to show you what is coming through. The big glaciers in Greenland have doubled their speed in two years, running at 14km a year, it is rocket speed for glaciers by any standard. They are dumping 100 cubic metres of water into the oceans and the oceans are going to rise in height at that sort of rate. (*New Scientist*, 11<sup>th</sup> Feb 2006)

From the Royal Society, and it is an honour to have a Chair who is part of the Royal Societies of the Commonwealth, this one (*below*) is talking about the economic models that we are running our planet on and they are pointing out exactly what Robert Costanza pointed out so well this morning, this problem of discounting the future and inadequate representation and so on. I thought that was a brilliant phrase and this is not lightweight stuff.

**"Traditional (economic) methods ... tend to discount the cost of future investment and give an inadequate representation of how people value the future, and the impacts of climate change beyond a few decades seem almost irrelevant.... Such methods may be effective for running a small company but they are no way to run a planet"** *New Scientist*, 11<sup>th</sup> Feb 2006

When you see it on the motoring pages (*Sunday Star-Times*, 12th Feb 2006) you really know there is something going on because motoring correspondents tend to be the last to pick up that global warning might be an issue, but it is there. Then we have got some very sharp focus on ‘if we don’t stop burning oil’ – it is just saying that we can not keep pouring the carbon, CO<sub>2</sub> out and one of the reasons is that this work reported on the fact that we now know we have had a lot more variability in our climate in our recent past, from about the Middle Ages to around the first Millennium, than we have had for the last two or three centuries.

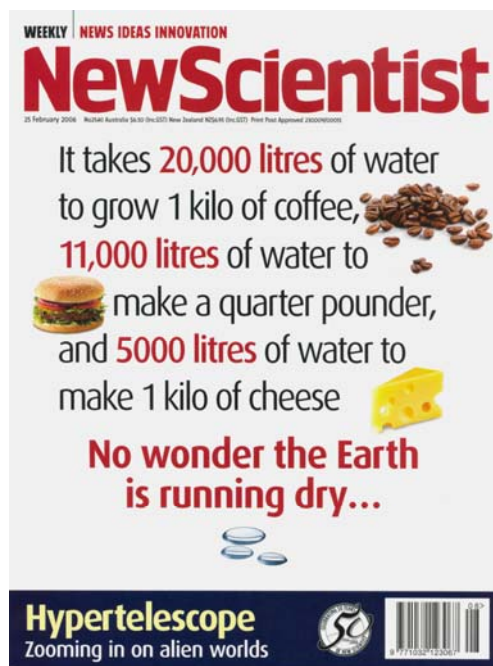
**“...greater climate variations imply greater future climate change”**

*New Scientist*, 18<sup>th</sup> February 2006

We have been in an extraordinary calm period in global history. What that has shown is that great climate variability is the norm and that the sort of forcing that we are seeing now through CO<sub>2</sub> and other greenhouse gases is exactly what tips you into very unstable periods.

This is a bit on water (*New Scientist* 25<sup>th</sup> Feb 2006) (*Figure 1*) showing the one thing that we are really in trouble on - fresh water. You simply can not substitute anything for fresh water. I have not met an economist that has worked out a substitutability one for that.

*Figure 1.*



Rod Oram (*Sunday Star-Times* 26th Feb 2006)- “Climate Change – We are Going the Wrong Way” - coming back last week from the Climate Change Conference in Adelaide was saying that as a policy framework here in New Zealand, we are going the wrong way. Essentially we have not got the focus that we should have, that many other countries have already picked up the pace and we have slowed down.

And just another one looking at “Under the Weather”, commenting on the reality here in New Zealand and this comes back to our thinking about our lakes here if we’re hit by more extreme weather.

**“We (NZ) will be hit by more extreme weather, more storm damage, more erosion, more floods and stronger westerly winds.”**

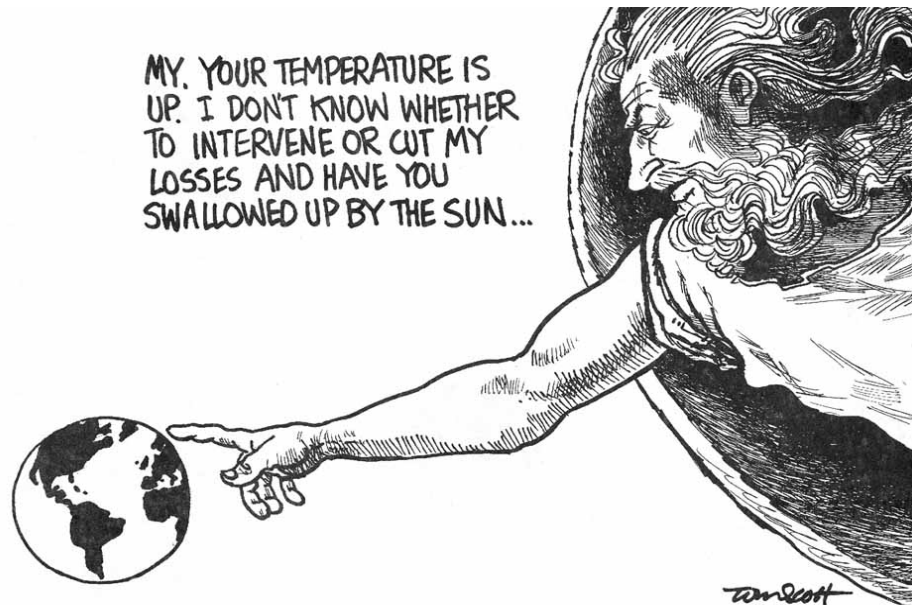
*Sunday Star-Times* 26th Feb 2006

So that is what we are facing, stronger westerly winds and more rainfall events. The last one was in *Time* 27<sup>th</sup> Feb 2006, “Has the Meltdown Begun?”

Now that is just what hit our coffee table over four weeks so there is a fairly large body of evidence coming together very fast now which says basically that there is a big acceleration going on. **That is the point** – there is an acceleration of the impacts of global climate change that seems to be coming very fast. It is tied up in things like “Era of Extinction” (*NZ Listener*, 4-10<sup>th</sup> March 2006) talking about what is happening in the Arctic. The polar bears have



probably got less than thirty or forty years left because of the way the sea ice is disappearing and their food stocks are disappearing. I have a very old colleague who has been working on them for forty years and he has the run out point at about forty years for polar bears.



The Lord had the last word – this was Tom Scott the day we signed the Kyoto Accord or it came into being last year.

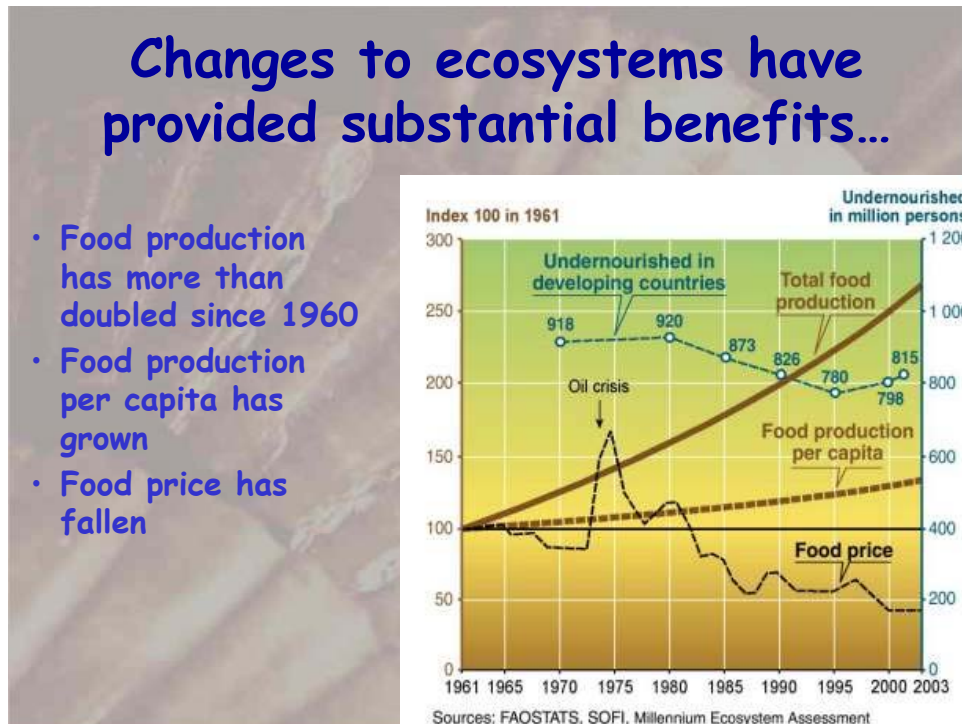
**Our planet is under increasing stress.  
We are living beyond our means at a  
planetary scale.... as many of us do  
with our personal finances!**

That is the canvas and Robert Costanza was making the same point. The reason I flash that up there is that everything that we do to work our way through the challenge in the Rotorua lakes has got to be against that canvas, it is a very, very mobile challenge that is coming in front of us. So design for perdition, design for extreme ascents, design for lots of water, and less water, and so on.

Start then to think about the other particular problems we talk about a lot, and this is the focus on the health of natural assets. Prof Costanza referred a number of times to the Millennium Ecosystem Assessment Programme without actually explaining what it was. It was a very large programme that came out of the work the United Nations started in the Year 2000 at the Millennium and basically it set out to do a stock take of the health of the planet. It is ongoing and the best piece of stock taking I have seen for a long while.

What it looks at are the positives and it said that we have made many changes to ecosystems. Of course, that is obvious in terms of creating systems that produce a lot of food, the graph (*Figure 2*) shows what total food production was, food production per capita and then food price. The interesting thing is that the food price has gone down as the price the ecosystem has been paying to allow us to do that in reality has gone up.

Figure 2.

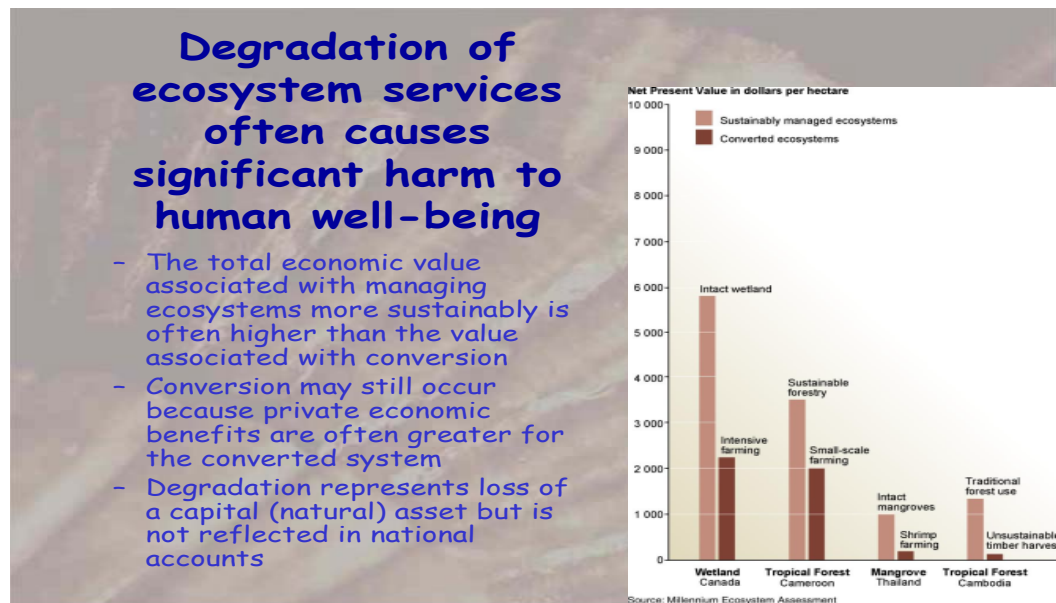


From other work I and my team have been doing, we can not find evidence that any market in the world pays the true ecological price of food. Every buying decision we make down at New World and Pak N Save every day are basically eating a bit of natural capital.

The regulating services graph was put up by Prof Costanza (Costanza, *Figure 6*) so I will not dwell on it, but what it is saying is that in terms of managing these extreme events – in this case we are talking about floods – those bars are for ten year intervals, so it runs from 1950 to 2000, and what it is showing is that as we have lost wetlands, forests and mangroves. The impacts are going up and that is what we need to think about here; the value of wetlands and forests.

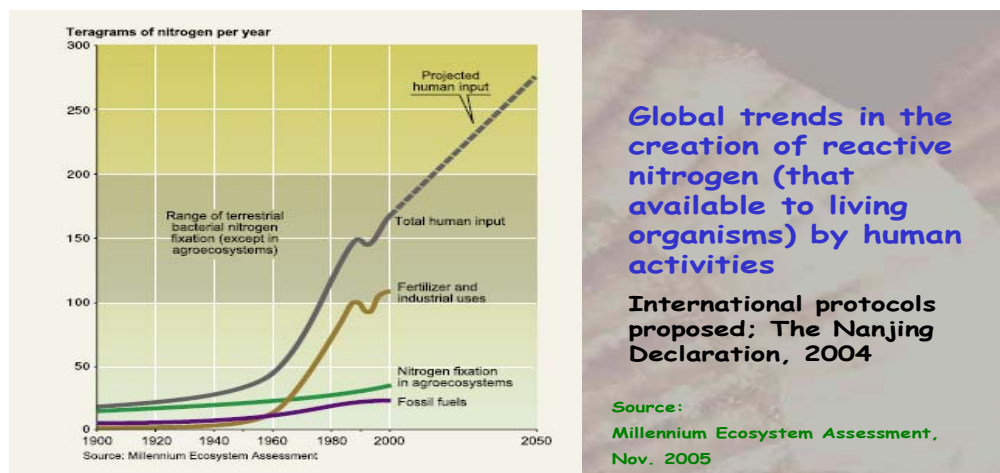
This is another example out of the Millennium Programme (*Figure 3, next page*), similar to one used by Costanza where he talked about the value of ecosystem services versus the value of those lands if we converted them. In this case we have an intact wetland in Canada converted to intensive farming; the Cameroon's forestry system, sustainable forestry versus small scale farming. A mangrove example converted to shrimp farming and remember what mangroves were worth in the tsunamis last year. The last one is traditional forestry use through to unsustainable timber in Cambodia. In all the cases where they have been untouched, their value is higher as ecosystem services.

Figure 3.



The one that is a real crunch, and we are part of in the Rotorua lakes, is the use of reactive nitrogen, (Figure 4) that we create through the Haber-Bosch<sup>4</sup> process, extract out of the atmosphere using a lot of energy. We have got the most free nitrogen floating around on the planet that we have ever had. It is a planetary problem again, but it is being played out at a local level. My pick is that we have had a focus on CFC's, the ozone hole problem, we have had, and still have an enormous focus on greenhouse gases and we are going to see nitrogen as one close behind.

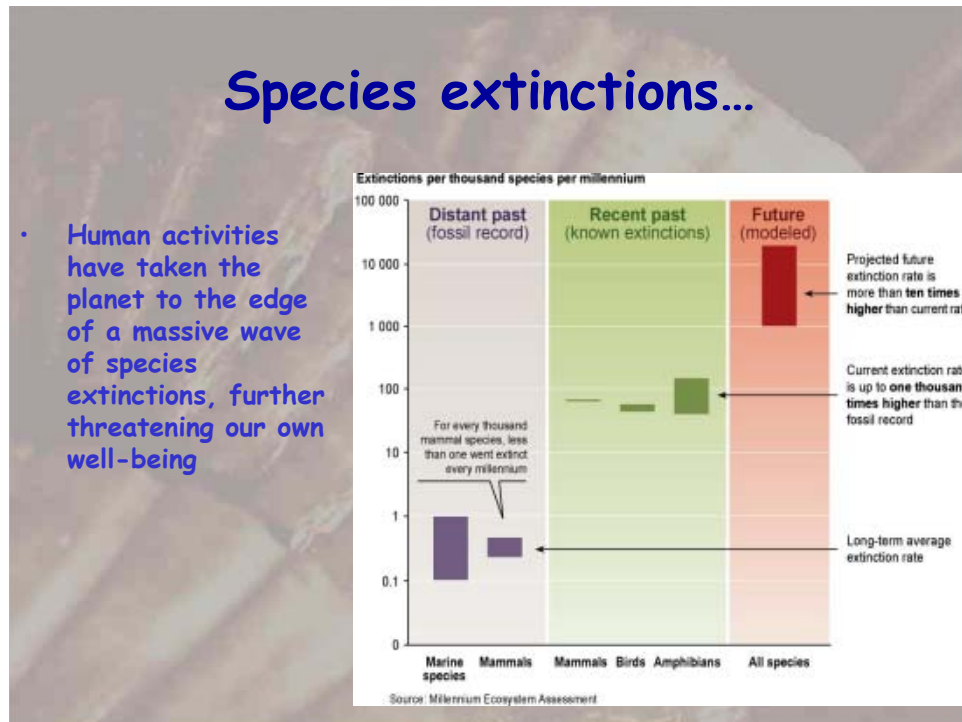
Figure 4.



<sup>4</sup> Haber-Bosch process, also called HABER AMMONIA PROCESS, or SYNTHETIC AMMONIA PROCESS, method of directly synthesizing ammonia from hydrogen and nitrogen, developed by the German physical chemist Fritz Haber. He received the Nobel Prize for Chemistry in 1918 for this method, which made the manufacture of ammonia economically feasible. The method was translated into a large-scale process using a catalyst and high-pressure methods by Carl Bosch, an industrial chemist who won a Nobel Prize in 1931 jointly with Friedrich Bergius for high-pressure studies. [www.britannica.com](http://www.britannica.com)

I would also refer to species extinction (*Figure 5*) and this is showing what the past rate is, the recent known extinction rate and the future rates – all these are going up very fast.

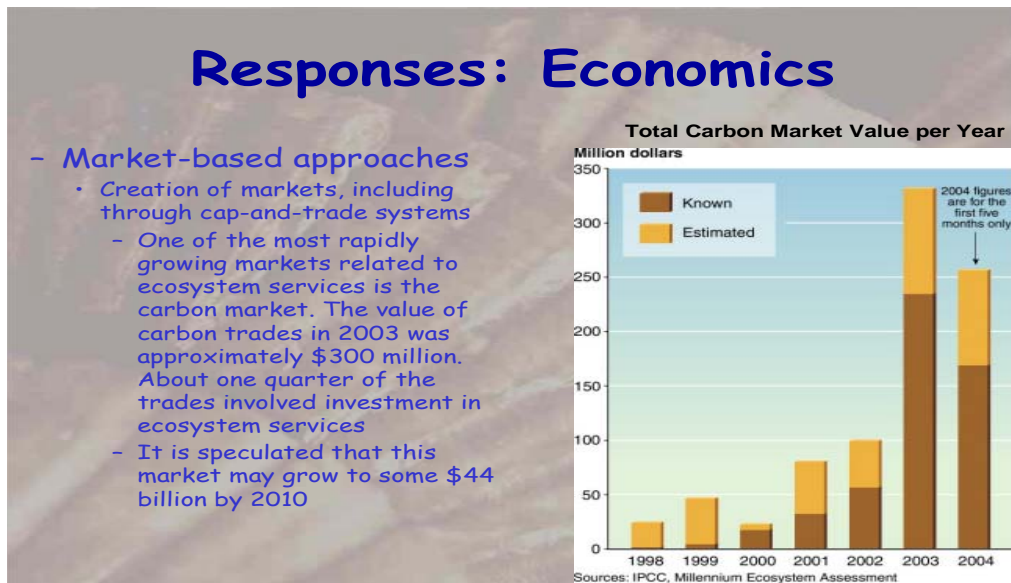
*Figure 5.*



In terms of responses to the economics Costanza is pointing out, (*Figure 6, next page*) this is where we need to think a lot more in the Rotorua Lakes context. How you use market mechanisms and where they are appropriate. Carbon markets are something that we are all going to have to be part of because it is a form of the cap and trade. We know that our planet can only absorb so much CO<sub>2</sub>, as we know our Rotorua lakes can absorb so much nitrogen and phosphorus.

In terms of responses to the economics Costanza is pointing out, (*Figure 6*) this is where we need to think a lot more in the Rotorua Lakes context. How you use market mechanisms and where they are appropriate. Carbon markets are something that we are all going to have to be part of because it is a form of the cap and trade. We know that our planet can only absorb so much CO<sub>2</sub>, as we know our Rotorua lakes can absorb so much nitrogen and phosphorus.

Figure 6.



From the Millennium Ecosystem Programme they highlighted these things in their summary late last year.

***“Among the outstanding problems identified...are the dire state of many of the world’s fish stocks; the intense vulnerability of 2 billion people in dry regions to the loss of ecosystem services, including water supply; & the growing threat to ecosystems from climate change and nutrient pollution”***

It came down to the threat to ecosystems from two things;

- *climate change*
- *and nutrients*

This is why I started with climate change and why getting a grip on nutrient pollution is the absolute key. So I do not know whether that helps. We are in good company in that what we are dealing with is a global problem but we have our local expressions.

What I want to spend a minute or two on is thinking about future proofing the lakes using the power of ecologies and economics; looking perhaps a little beyond all the fantastic things that are going on and thinking about:-

- *Working the catchments*
- *Blending land uses; forest systems have to be part of the future*
- *Using the power of wetlands*
- *Trading the nutrient loads (catchment specific cap-&-trade systems),*
- *Capturing carbon values*

There is a fantastic focus on the catchments and the tricky thing is where some are linked to others. I do not know that we are focusing enough on the land use and forest systems have to be part of land use. I believe we have been timid about cutting to the chase in this area. The power of wetlands, they have been recognised as constructive here.

We also need to think about trading the nutrient loads - cap and trade. The point is that there is no way we are going to be able to grandfather nutrient loadings at a farm level in any catchment without looking at the whole catchment. There is a lot of scope to capture carbon values. In other words, think about growing carbon, sequestering carbon as part of the future picture because there is a very big market building up and there is investment looking for a home there.

*Figure 7.*

### **The hard numbers; nitrogen inputs to Lake Rotorua, Oct 2004...**

<b>From</b>	<b>Area:ha</b>	<b>% cover</b>	<b>N/t/yr</b>	<b>%</b>
Native	10,588	23.9	42	5.5
Exotic	9,463	21.4	28	3.7
Crop & hrt	282	0.6	17	1.4
Pasture	20,112	45.4	573	75.0
Lifestyle	556	1.3	11	1.5
Urban	3,267	7.4	50	6.6
Geothermal			42	5.5
<b>TOTAL</b>	<b>44,268</b>	<b>100</b>	<b>763</b>	<b>100</b>

*Figure 7* is the only piece of data I have pulled out of all the superb work to date. Paul Dell put this up and I have just got an addition to it in the sense that is the nitrogen. We know where most of it comes from out of the pasture system and we know that it is 75%. At the end of the day, there is no shortcut but getting our heads around how we manage it. To do that I think we need to lift the conversation about what it is we are growing, where we are growing it and how we create value from that growing.

*“Weaving Resilience into Our Working Lands”* is a study my team did four years ago looking at the place of native vegetation on our farms; not just as riparian plantings but as part of the wealth creation system in all sorts of innovative ways. Because our feeling was, and still is our view through lack of evidence to change, that we have a remarkable construct when we are thinking about our biotic production systems in New Zealand. Virtually all our wealth is being created out of the biology of plants and animals, but particularly plants that came from somewhere else. They are somebody else’s domesticated species or tree. We make very little use of the unique characteristics of the fauna and flora, particularly the flora, of New Zealand which has spent eighty million years adapting in some very turbulent times.

**There is mounting evidence that more ecologically diverse systems are more ecologically resilient.**

*“reduction of variability of living systems from organisms to ecosystems inevitably leads to a loss of resilience”*

Holling et.al. 1995

Think about it as a resilience characteristic and could we make more use of it. We believe that we could so that is why we got stuck into it and for the reasons above. We also know from the great systems-ecology work that is going on around the world that there is a lot of evidence that more diverse systems, whether they are in a farming system or whatever, are more resilient; they can stand perdition. We are not just wedded to our indigenous species; there is certainly a lot of place and space for our exotic plants and trees to create wealth.

When you look at some of the more robust parts of New Zealand's farming landscape, you realise how many trees are there and the diversity. Here we have trees like poplars doing a job on the slope, this is a lot more native vegetation in a beef system, and there we have radiata. (*Not shown*) These are scenes we are familiar with but in our discussions about the lakes I do not believe we are thinking hard about **trees, trees, trees as part of our system**. There needs to be some cross over thinking here for the farming future.

*Economic and environmental sustainability gains could be derived from more innovative uses of **native**, as well as **exotic plants & trees**, by our land based industries.*

The viability of the farm future also needs to be crossed over into energy futures in New Zealand because one of the things about most farms in New Zealand is that their income is entirely sitting in the export economy. We export most of what we grow and we are good at it. But part of the buffering in a world where energy and carbon based energy is constrained, is to think about how you can actually start to invest from a farm business in being part of that energy future and at the same you actually put part of your income into the domestic economy. So ecologists think quite a lot about economies.

So, we have a lot of the pieces but how is the assembly going? That is the question that we ask. Coming back to the questions I was posing, what I really want to highlight is that I would like to see a lot more research going on. In the transition of land use in the pastoral systems, we build a lot more trees into it. It is not simply riparian planting; it is how do we build them in that create value in terms of their ultimate harvestable value, in terms of their carbon sink value?

I have had two groups through my office in the last month representing interests in the US. In both cases they are looking very hard at our policies in New Zealand - the ability to privately own carbon which currently is still on the table under our greenhouse gas policies, the permanent forest sink initiative. They are interested because there are blocks of funds that are looking for a place in a stable democracy to invest in carbon sinks, where they put capital up front and of course want a share of the carbon value at the end.

So there are some smart things that we could do that would actually have great value to the catchments of the Lake Rotorua area and share that ecosystem service wealth between us and other communities. Let's see if we can open that one up in the work as it goes forward, this innovative action that is here.

I will not talk more about wetlands because you are already focusing on those and wetlands are the kidneys of the system – we know that and we know that they are very powerful tools to managing ecosystems.



Let's get down to the nutrient loadings in catchments. I know there has been extraordinary debate about what to do with these at the present time, whether you work out what each property has got, and you have to do that at some stage. There have also been equally big debates ongoing about whether you grandfather loads to a property or whether you actually spread them across a catchment. The reality is that it is the catchment, recognising that there is some inter-linking, that is the entity that has to carry the load. At the end of the day, the carrying capacity is in that catchment and I do not think it is politically viable in the long-term to have a grandfathering process. I think we have got to have an allocation across the catchment process and that is where you get into the cap and trading systems.

That seems to be the way this is going, it is with carbon and it is in the nutrient area in other parts of the world. We have to work out how to do that in fair, equitable ways, because not to do it is certainly not equitable in the long-term. That is where using some of the resource around the potential of a permanent forest sink initiative which is currently on the table as part of that picture.

The last piece I want to talk about is the really critical element, how do you maintain this effort, the effort that we've heard about this morning, over decades? We know that that's what we have to do.

Already we have vehicles there:-

- *Rotorua Lakes Joint Strategy Committee*
- *LakesWater Quality Society*
- *Rotorua Lakes & Land Trust*
- *Vision Rotorua*

How do we resource:-

- *grants*
- *special rates*
- *natural capital "super fund"?*

Why not put something like that there? From Paul Dell this morning we heard about the importance of Central Government investment. Yes, New Zealand has to invest in what is going on here; it is not simply a local problem.

I will digress for a minute on the importance of the conversation around that, because at the end of the month I am taking part in a workshop in Western Australia which has been put together by CSIRO and a research organisation called Land & Water Australia. It is a very innovative piece of work. They have eighteen from all over the world together to help on a piece of work that is looking at communities who deal with big resource management issues. This is at a time when western governments for the last twenty years have been devolving the management of these big tough ecological resources, natural capital issues to the local level, because "it's a local problem".



“Well, yes and no”. What has happened, and it is playing out across the landscape of Western Australia, is the devolvment from the many - as in the 1.3 million who live in Perth, to the few who live right across the western wheat belt, and the load on the shoulders of the rural community is just becoming intolerable. They cannot carry it, simply in human capital terms, nor in physical terms. Yet the ecosystem services that they are to sustain and restore, in this case we are talking about salinity here, is something that is of benefit to the whole of Western Australia and the whole of Australia. So this study is looking at how in fact you break out of that log jam, and it is focusing on the human capital.

I think that is the issue here too because there is no way that this is a local problem. **It is just an expression of a national problem, an international problem, playing itself out at a local level.** So Central Governments have to buy in and seriously, there is no way round it, and be very innovative in how that's funded. These sorts of processes are about a very high level of engagement between the groups.

This is the Land Care group planting up (*not shown*). It is learning by doing and I have heard adaptive management used a number of times, and actually it is critical. Time is limited, you have actually got to do the sort of things you are doing now, but not get carried away like the US example, (Lake Delavan, Wisconsin). They tend to go over the top you know, get the Army in there and you do great things like Iraq I suppose. With adaptive management you go on an 80/20 rule and monitor and research it very well as you go. It's good science on the roll and I think having people like David Hamilton here leading is a coup.

One of the things I wanted to finish this piece with is sharing with you an example of a Canadian group that has come together, and Marion Robinson is representing it. I am not stealing Marion's thunder because I suggested that she come and join us here; but it is one of the best examples I know in a big catchment, Fraser Basin catchment running down to Vancouver. A beautiful country which has got a lot of resonance for us, where they have put together a model of an entity that is embedded in society that is focusing on dealing with these big thorny catchment problems. Marion will fill this out in greater detail but the group is made up of support from Government, private sector and civil society. It is a non-profit trust that sits entirely independent of Government, a council with these roles:-

- *Sustainability educator*
- *Catalyst of collaborative action on complex sustainability issues*
- *Impartial multi-interest convener and facilitator*
- *An established inter-jurisdictional network*
- *Objective recorder of discussions and agreements*
- *Reports on progress towards a more sustainable basin*

It is similar to some of the things that you are doing here; it is about being an educator, getting in and rolling up the sleeves where there are gaps, bringing people together and building agreement. One of the most important things they have done is a Charter for Sustainability which was talked about at the end of Costanza's talk. Get your clear vision; get some consensus on where you are trying to go. That has already happened to a large extent here in the Rotorua lakes region. Compared with three or four years ago it is dramatic how focused everybody has become. The other important part where I and my team think we need to lift

the game here in Rotorua lakes is to get some good indicators out there. Get out a regular report card on the progress that is going forward, which a number of people have talked about. It is really knowledge to navigate and not just the physical things. This “Sustainability Snapshot” (a Fraser Basin newsletter) is put out every two years by the Council with sixteen indicators across the board – environmental, social and economic. It is a remarkably powerful picture of the progress that the Fraser Basin community of 3½ million people is making. It is simple and did not cost an arm and a leg, in fact about \$120,000 with support from sponsors. The local newspaper published it and it went out to a lot of people.

That is what we need up and running here because the story that is coming together should be projected. It means not just measuring the health of the lakes, but also the health of you and your energies. Are your community groups holding together? Measuring social transactions as well is important to help navigate. This is why we are releasing a report about the Lakes in early April, highlighting this building community strength, building the nature of the Strategy Committee and a sustainability report card.

I think those are the two most important things. Incidentally, what is this report about? We did a scoping of all the progress and effort going on here? We had a number of approaches to investigate the Rotorua lakes problem and we then decided that we could not add any value here at the moment because there is already so much superb work going on.

All we are saying in this report at the end of the day is the two areas we think would help:-

- Expand the membership of the Joint Strategy Committee. Weave it more tightly back into society. The journey is ten, twenty, thirty, forty years; you need to have an entity, perhaps like the Fraser Basin Council, that sits entirely out in society, not something that is operated from within Local or Central Government. Institutions in society tend to last longer than work programmes within democratically elected bodies, particularly when they are on a three year electoral cycle.
- Get a report card together.

We have a few other things in terms of research which is keeping up that investment and we do need to sharpen the focus on carbon sinks.

To sum up where I started – climate change will shape every aspect and most endeavours and I would like to see pro-active thought in terms of building it in.

- *What is going on here*
- *What is NIWA predicting at the regional scale that we are going to have to deal with in terms of water flows, etc*

Put it right up front because it is going to be right up front. Build resilience into land use, in other words more trees, more wetlands. Think about it in those terms but use innovative economic and policy tools because this is not going to be a sort of gentle progression, there has got to be some step changes made here, some tipping points. David described so powerfully tipping points in lake health; we actually need the same sort of step change tipping points in our responses to those. We need to look at the limits to nutrient capacities in terms

of how they are shared between landowners. If we do not spread it across catchments and get means of trading, I think we have got some severe inequities sitting in the system.

Finally, we need to maintain the effort for decades, robust, community based organisations are essential and you have all the platforms here. Passing the baton inter-decadal and inter-generational is quite a challenge and we need to have that conversation now, knowing that the groupings of enthusiasts who have got to this point have got to think how they pass the baton and how they engender the interest and love of the land and landscape. It is deeply cultural, how you pass the baton and how you sustain the effort.

I am going to finish with a reflection on what I call the “Invisible Elephants” (*Business Day Executive, Dominion Post 17<sup>th</sup> Feb 2006*):-

***Beware the worlds of “bounded awareness” and  
‘behavioural blinders’ – they are high risk attributes  
when facing the challenges of climate change  
and the new land and water management needs  
as have emerged in the lakes and their catchments.***

The article was about the difficulty that the Australian Federation Government got itself into over the way it was selling wheat to Iraq. What is the relevance of that? Well the relevance is this – that the group selling on behalf of Australian wheat growers was so focused on getting the best price for the wheat in their deal with Iraq, that they were absolutely blind to the fact that the trucking charges they were paying to get it from Jordan had a big kick-back to Saddam Hussein. That is why there is increasing focus on characteristics of “Bounded Awareness” and how we deal with things when they are big, complex, interconnected systems. This is what we are dealing with here and we have to be constantly alert that we are not “blinkering” and having that bounded awareness when dealing with things that are so interconnected and long-term. It comes back to people and I will leave you with this quote because I think it sums up what is going on here:

***They were “nothing more than people by themselves...  
But all together, they had become the heart and  
muscles and mind of something perilous and new,  
something strange and growing and great. Together,  
all together, they were instruments of change.”***

– Keri Hulme, *Bone People*

## **QUESTIONS**

*Brian Bell, Nimmo Bell:* Morgan, thank you very much for that address. I would like to go back to the point you made about our being too timid on land use change. First of all I think we have to realise we are dealing with people’s livelihoods here; and secondly, if we are going to look for innovation I do not think it is going to come from the bureaucracy in Wellington. If we get the environment right for individual decision makers making decisions about land use, the farmers themselves, which is conducive to change, then that is where we will get the biggest bang for our buck. I would be interested in your comments on that.

*Morgan Williams:* I am not for one minute suggesting that solutions are coming out of Wellington, if that was an illusion I was providing. What you do need is support and I think that is coming. Why I say that we are too timid is because my concern is that ultimately we will not get in place systems that will protect the family owned businesses that are there now. I think we are saying the same thing but looking at it from different sides of the glass. I think the time frame is relatively short, and a lot shorter than we think. I am not sure that we are being innovative enough about how to protect the investment that is in that property and how to be fair about the transition.

This is why I talk about needing innovation in the sense of investment in carbon sinks and where that investment and the mechanisms through which that investment might actually be sought, because I think that is going to be an important part of the transition. It seems to me if you go back to that table which Paul used and I had a sub-set of, the absolute bottom line in terms of nitrogen and to a degree phosphorus, is we know where it is coming from, so we have got to work out how we intercept and change the practices that are generating that. But in saying that, I am not suggesting you throw all livestock off tomorrow, I am saying “how do you do a transition with those businesses?”

*Margaret Murray-Benge, Western Bay of Plenty Council:* I would like to comment on the rural farmers who have over the decades been given incentives by Government to strip their land of bush and then as time goes by they have to protect it and now there is a need for more trees. We heard this morning from the American speaker (Costanza) that taxation incentives were an option. As you are independent of the Government, can you see taxation incentives coming from Government as being the effective tool to bring trees back to the land and change land use habits in a great hurry?

*Morgan Williams:* If you want a simple answer, yes. If you want the more complicated answer, it is how you extract it. I think the reality is that businesses everywhere, which includes all of us, respond to the signals that are out there. Even as frequently as the 80s we had a whole lot of tax structures in New Zealand which had us rushing into Kiwifruit. I forget what else it was at that time, alpacas I think. Taxation systems are very powerful motivators and so we should be looking at both the motivators and the demotivators.

In terms of demotivators, we looked at the taxation structures around planting indigenous versus exotic as part of the study I referred to earlier, and they were quite tough in terms of planting indigenous, there was no level playing field. It was much better to plant radiata than to plant natives. We focused on the taxation system because one of my staff happened to have worked for Inland Revenue for some years. That has been changed so now you've got a level playing field, so we've got to do that side of it, make sure the playing fields are level.

At the moment it is not a level playing field in terms of whether you're a forester versus you're a grass grower. It's an un-level playing field in taxation terms still, in quite a lot of ways. It is also not level in terms of the rules under District Plans around the country, in terms of permissive and discretionary uses and so on, so there's another layer there that we need to look at. So you can't get off into straight investment coming from anywhere, particularly from Central Government sources but I would say also from Regional Government, until you make sure that you've got the taxation sorted out, in other words the

business platform needs to be level. At the moment it's not level from everything I can see. It's disadvantaging trees over grass, so as a Regional Councillor, I'm sure you can do something about some of that.

*Marcus Wilkins, LWQS:* Dr Williams, as Commissioner for the Environment, how do you see the removal of all these pine forests to make way for pastoral farming and the introduction of high fertiliser?

*Morgan Williams:* I am fascinated and baffled. It depends on the time frame you are looking at. I think you have to maintain flexibility in land use changes but I am not sure there has been enough thinking about what that means in terms of our total CO<sub>2</sub> position, to take 80,000 hectares and gradually transform about 60,000 of that to pasture. It has got a consequence and I am not sure I have seen any rigorous analyses as to what that consequence is. So it interests me.

## The Te Arawa Tribe's Relationship With Its Lakes

Anaru Ririwai Rangihueua, *Chairman Te Arawa Maori Trust Board*

*Anaru Rangihueua as Chair of the Te Arawa Maori Trust Board, a group that has 750 years of history with these lakes and with our community. He is also member of the Rotorua Joint Strategy Committee, the group that controls the management of the Rotorua lakes and includes Environment Bay of Plenty, the Te Arawa Trust Board and the Rotorua District Council*

Anaru will provide a historical and cultural perspective on the importance of the Rotorua lakes and their need for restoration

### He Wai Te Ka

Water is Food

"Piki mai, kake mai, homai te Waiora ki ahau ...e...e!"

"Come forth, gather, provide me the Water of Life...e...e!"



Kia ora everybody. Dr Morgan Williams began his delivery with planets under threat and I think that should be a concern to all of us. Planets without people and what is the most important thing – people, people, people. So Dr Morgan I support your earlier comments about our planets under threat.

Our planet without water – I wish to begin my speech by firstly sharing with you a quote from a favourite I am sure of many of us, a small piece of verse by Samuel Taylor Coleridge from the Ancient Mariner and I think everyone of us repeat it automatically sometimes:

*"Water, water everywhere and all the boards did shrink ...  
water, water everywhere and not a drop to drink."*

That's what our planet is under threat from. And here we are today working out avenues of how to work together to divert something to encourage the sustainability of our waterways, our lakes and our environment.

*Tena Koutou.* I'd just like to extend and support the welcome given to you this morning by our colleague Tai Eru. I wish to begin my speech by also sharing with you an ancient Maori proverb which I consider to be appropriate to the topic of discourse here today.

Now here we are, a small scene of a family group eating on the shores of our beach. The ability for us to continue to take food from our sea, from our lakes, from our waterways is so important to provide sustainability with our people.

*“He Huahua te Kai? E he, he Wait e Kai”  
Are Preserved Birds the best food? Ah, no, water is.*

My name is Anaru Ririwai Rangiheuea. I am the current Chairman of the Chairman of the Te Arawa Maori Trust Board and will be speaking about my tribe, Te Arawa, and its unique relationship with its numerous lakes.

My middle name is Ririwai, literally means, “Rushing Water” or Turbulent Water”. It was the name of my great, great, great, great grandfather, a prominent Chief of the Tuhourangi tribe who once lived in the Lake Tarawera district.

How and why my tupuna (ancestor) Ririwai was so named is lost in the passage of time and may never be known, however it ever serves to remind me of the significance that water held at the time of his naming.

#### *Cultural & Spiritual Significance of Water*

Many of us seek the stories that were told by my ancestors about the beginning of time; **Ranginui** (Sky Father) and **Papatuanuku** (Earth Mother); about the creation of all things; the **whakapapa**, the genealogical web that shows our connections, our relatedness to all things through the children of Rangi and Papa. These stories show our inter-dependence with the life force of every natural thing in existence and therefore how we are to respect all things and the correct ways to interact with them.

But such stories and their teachings are **taonga** (treasures) and are therefore very valuable. They were only passed on to those who would respect the knowledge contained within and honour the messages, guidance and the learning that they offer. That is my **wero** (challenge) to all of us here today.

Now when a Maori asks “what is your name”, he or she will say: “Ko **wai** to ingoa”? Wai in this context is a direct reference to water, thus our existence or being according to my people, is inextricably linked to water.

All races in the world ... indigenous people and white people in their own way are clear in their stance that water is sacred. It is almost like a sacrament – and it is used that way in the daily lives of the people, no matter where they live. Maori people try to maintain the relationship they have had all their lives with water but when pollutants are added to the water or worse still, their ancestral water bodies are taken from them, the **Mauri** (spiritual life force) of the water as well as their cultural rights are stolen from them.

According to Maori, all rivers and lakes contain a **taniwha** (serpent) which acts as a spiritual guardian of that water source. Sadly, however, the taniwha would cease to exist if the waters became contaminated.

In times of crisis, my people would go to the lake or river at dawn to seek healing. They would face the rising sun, pat the water, sprinkle themselves, call on their **tupuna** (ancestors) and draw inspiration and healing from it. Such rituals and karakia were an intrinsic part of their lives and we do that virtually daily. You will see that at **arupa** (cemetery) when people come out, there is water there for them to sprinkle themselves with for protection. Even at the blessing or unveilings, they sprinkle water – so water has very important cultural uses for our people.



### ***Nga Momo Wai (Different Water Body Types)***

The following in an anthology of names the Maori people apply to the various types of water:

**Waiariki** – Collective term for geothermal hot water. Water of the gods.

**Wai horoi** – Water that is used to bathe in or wash clothes or other personal possessions.

**Wai Inu/Wai Unu** – Water that is used only for drinking. Drinking water is not taken from a source that is used for washing unless there is no alternative, and then it should be taken from the stream at a specific time of the day when washing of clothes or bathing is not permitted.

**Waikino** – Water that has been degraded or altered to such an extent that it can cause harm or water that conceals hidden dangers.

**Wai makariri/Wai matao** – Cold water, mainly cold fresh water.

**Waimaori** – Water than runs freely and has no particular qualities. Ordinary water.

**Waimate** – Water that has lost its mauri or life force. It is dead, damaged or polluted with no ability to sustain life. It can contaminate other living or spiritual things.

**Waiora** – Purest form of water, a source of well-being and life. Used for cleansing from sickness and to create positive energy. This water can become waitapu.



**Waipiro** – Slow moving, slack water, often water that smells, such as repo (swamps). These waters are still able to provide many sources such as rongoa (medicine), dyes for weaving harakeke and tuna (eels) for kai (food) and homes for many living organisms. Also a colloquial term for alcoholic beverages.

**Waipuke** – Flood or flood waters.

**Wairere** – Waterfall.

**Waitai** – The sea, surf or tide. Used to distinguish seawater from fresh water.

**Waitapu** – Water that has had a ‘tapu’ imposed upon it. Water that is used for special ritual practices, eg. Tohi and pure: baptism and purification ceremonies. Water that has no sanction against most everyday activities perhaps because there has been a drowning also known as a ‘rahui.’

**Waiparu** – Unclean water.

**Waitupapaku** – Water used for cleansing bodies and bones before traditional burial.

**Wairua** – The spiritual essence of water.

*Nga momo ingoa mo te Kupu Wai (Some Maori place, stream and lake names bearing the term water)*

Throughout Aotearoa (New Zealand) today you will encounter names of places, streams and lakes which incorporate the word “wai” or water. A few examples are:

**Waikaremoana, Waimakariri, Waiwhetu, Waiohau, Waiirohia, Waitotara, Waikaukau, Waitaha, Waiohewa, Waiomio, Waiomio, Wairoa, Wainuiomata ... and so on.**

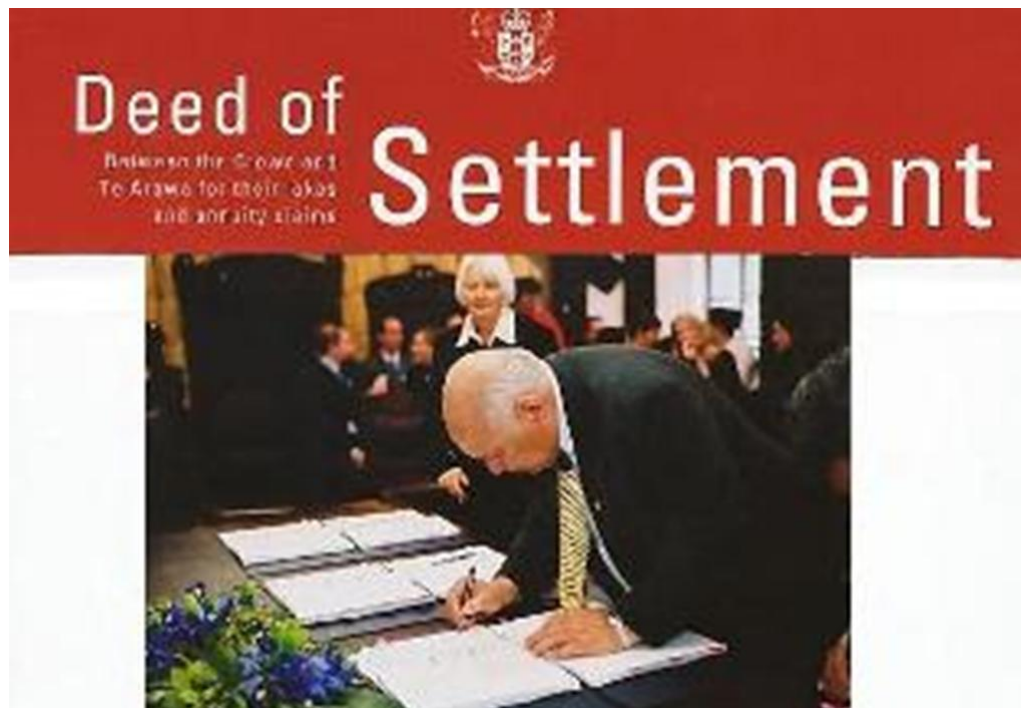
*The Te Arawa Tribe's Association with its Lakes*

When my tribe Te Arawa landed at Maketu its people settled the local coastal areas and eventually moved inland to inhabit the lakes district onward to Tongariro, Taupo. During their travels they named and settled around the numerous freshwater lakes, establishing their **pa** (settlements) and **kainga** (homes).

Following are the names of lakes named, managed and utilised by Te Arawa:

**Rotorua, Rotoiti, Rotoehu, Rotoma, Rerewhakaitu, Rotokakahi, Okaro, Okareka, Okataina, Tarawera, Tikitapu, Ngapouri, Ngahewa, Tutaeinanga.**

Today the many **hapu** (sub tribes) associated with the abovementioned lakes maintain a special relationship which endures today. The lakes hold immeasurable and special value for them both spiritually and culturally. They draw their identity and connection to these lakes through **whakapapa** (genealogy), **ahi ka** (rights of tenure), **mana whenua** (traditions) and **manaakitanga** (respect for the guardian taniwha and respect for the mauri or purity of the water).

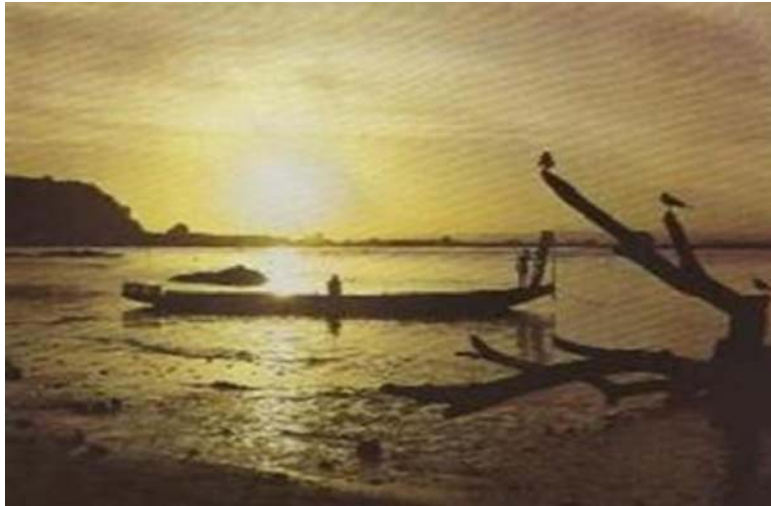


### *Government's Redress*

On its settlement the Crown acknowledged Te Arawa's cultural, spiritual, historical and traditional associations with its respective lakes. Although the Crown was alerted to the continued release of sewage into the lakes contributing to the poor water quality situation the lakes are presently in today, it believed it was not compelled to compensate Te Arawa for damages in any way.

To assist in the clean up of the lakes, the Crown supported the establishment of the Rotorua Lakes Joint Strategy Committee, comprising the membership that we have heard continuously throughout this symposium – the Rotorua District Council, Environment Bay of Plenty and myself down at the Trust Board. And it is a group that's working. It is a group that we have a commitment to work together and I think for some time we have not seen this relationship develop as we have let it develop now. I think it is strong and I think it is good and I think the investing that we have from the related community groups and Paul Dell showed a lot of that in his presentation this morning.

The Group's work and responsibility is extensive to find ways both culturally and scientifically to clean up the lakes in a practical manner.



### *Conclusion*

The lakes are important to the Te Arawa tribe for the provision of food and other material resources. They are transport routes and central to the personal identities of each sub tribe of Te Arawa. They are places of spiritual and traditional customs and practices and connect to the whakapapa (genealogy) of each individual of the many constituent hapu.

The hapu of Te Arawa held mana over their respective lakes. They controlled access and the harvesting of plants and indigenous foods and fish. Unfortunately, however, the introduction of exotic species of fish and the pollution entering the lakes caused Te Arawa major concerns, primarily the imposed effects they had on the mana, mauri and wairua of the lakes.

To conclude, I wish to quote the words of a kuia (elderly woman) from my own sub tribe, with regard to the ancient Maori lore of resource management:

*“Managing our resources was a way of life when I was growing up. Our resources were our livelihood and therefore, carefully looked after. Sustainability was not only about protecting resources but also about routine. We had a routine and we had disciplines. There was no management without discipline. Resource sustainability meant our own survival. Conservation is a very important part of resource management, but exploitation is also.”* (Bubbles Mihinui, page 21, “Whenua – Managing Our Resources”).

And I pay tribute to that old lady, she would have been here today I'm sure.

***Na reira, tena ra koutou katoa.***

So I just want to end and I ask Tai to help provide a ***waiata***. A waiata is a flow of song.



## QUESTIONS

*Don Atkinson, LWQS:* Perhaps I should pose a question to you, if that's possible? Obviously Te Arawa were very disappointed that the Government were not prepared to compensate you for the state that they handed the lakes back in. Clearly they were pristine and we heard Don Stafford this morning speak about the quality of the lakes initially. Do you think that their removed involvement in Wellington, rather than being part of the Joint Strategy Committee, effectively allows you a full voice with them?

*Anaru Rangihuea:* The matter of all of the lakes coming back to Tarawera has been traversed. We have spoken about that and we did receive a little sum for a cultural redress. That has been considered. But when we talk about the amounts of pollution that has affected all the lakes, it is more than what we could possibly get from the Crown. What was that other part of your question?

*Don Atkinson:* Really I am asking, do you think that their direct involvement in the strategy group that now manage this process would be beneficial to them having a full understanding of financial responsibility?

*Anaru Rangihuea:* Well I believe it is a way that we are now able to work with the two Councils and as I mentioned to Benson-Pope when he was here, the two Councils have the resources to work with our groupings and the Trust Board has not got that rating resource like other councils. But we are only too happy to work as part of the group today and to have my people being brought on side. The main thing for us, for iwi, is consultation and we are still going down that process at the moment and I know Paul is very aware of it, to work and to alert our people of what is happening here, what we are doing here and with regard to the Kaituna River. That has been a subject of concern for those people down the coast, so we are trying to clean up here so that the water will continue to get no worse than it is now, even better. And I think that is the only opportunity we have had so far and I am sure that Te Arawa will tell the two Councils if they are not satisfied with what is happening with the lake clean up.

# How we can estimate lakes' economic values, and what do these values mean?

Dr Pamela Kaval  
*University of Waikato, Hamilton*

*Pam is originally from New York, but she did her PhD in Colorado State. She has been here for two and a half years working on the value of economic services and her interest is in estimating the value of economic services*  
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## TRANSCRIPT

I am happy to be here to speak today about economic values and what they mean. Hopefully I will give you a really good generalisation and by the end of the presentation you will be able to do economic values by yourselves and hopefully I will not be out of a job. I am just going to go over four basic points; my objective - general economic background. Again it is just going to teach you exactly what I do but in pretty general terms, and the different tools that I use to actually measure value and give you some examples what I have done in New Zealand, so you can put all the tools together and see how it goes, and then just some conclusions.

Three of my basic objectives are:-

- *Why Would We Estimate Values of Lakes?*
- *How Do We Estimate Values of Lakes?*
- *What Do These Values Mean?*

It seems like people have talked about this a lot already today but let's go over it one more time. How are we going to estimate these values? How do we put it all together to actually come up with values, and what do these values mean? Think about why are we going to put a value on something like a lake or why are we going to put a value on any type of environmental good, whether it is a tree or a bird, endangered species and how are we going to do this? Valuing that environment is really important because:-

*if you do not value the environment,  
then all costs and benefits have not be accounted for*

Basically the reason that we are valuing the environment is because there are many costs and benefits. In general I look at a part of land or a lake and there are going to be several different options of what we can do. For example, in Rotorua, imagine that the Council owns about 100 hectares of land right next to the lake. What could they do with it? You could do nothing with it and that would be fine; the trees would grow, people would go by, but you could actually do something with it. Say, just for two really simple examples, we can make it into a picnic area that overlooked the lake and we could make it into a tree harvesting area where we have some forestry and say, after twenty years we will cut the trees down and make some money. We have costs and benefits for both of them and we assume that we are not going to do the "do nothing" option, but if we do the "do nothing" options that would also work. We are not actually going to make any money if we are thinking about our benefits in

cost from that, but you are also not going to spend any money. So the “do nothing” option is pretty cost-less, it is just that the land value would actually be going up, but since it is Regional Council land, we are not really going to be thinking about that.

With the picnic area option it is still going to cost us money. We are not going to charge anybody any money to go to the picnic area so they can use it for free, so if we think about the benefits, monetary benefits, there are no technical monetary benefits but there are lots of costs. We are going to have to cut down a few trees, we are going to put up the picnic tables, the picnic tables are going to cost us money. We are going to have to hire people to do that, we are also going to have to mow the grass, if there is some grass around, to keep the area open, so we have several costs. So if you think about it for the picnic area, we have our two options. We can do nothing and again, your do nothing option is not costing us anything at all; we can have a picnic area and we can also have this forestry area. So with the picnic area the Council is not going to make any money, but we are going to spend money so it is going to have a cost to us.

After twenty years in total we would spend maybe \$100,000 for this picnic area and (well I can make it a million dollars if you would prefer, just add a couple of zeros!). Let's just say for this picnic area that is what we are going to do; our other option is to make it into forestry land and the trees we will assume are going to be ready to harvest after twenty years. So first we have to clear the area, then we have to plant the trees, then we may have to fertilise depending on what type of trees we are growing and then we harvest these trees. So after twenty years we have spent in this small area of maybe 50 or 100 hectares, say \$300,000, but we sold the trees for \$400,000.

So on forestry we made \$100,000 which is a plus. The picnic area is a minus because we spent \$100,000 and doing nothing is zero. In the past when economists just thought about benefits and costs and we did not have any other costs or benefits to think about other than these monetary costs and benefits, then the one making \$100,000 would be the one we would end up choosing. On that line of thinking I know some American Presidents right now that would think, “oh well this one we are making money, we can use this for oil instead of the indigenous species there, we are not going to make any money so we should use it for this because it is positive.”

That is just one way to think about it. But if we are doing that, we are not accounting for all the costs that are actually available to us. An example I like to use because a lot of people have seen the movie “Erin Brokovich” with Julia Roberts. I am not trying to promote the movie but it is a good basis to see what costs we are missing. In the movie there was a gas power plant in Hinckley, California. So imagine in California, not too far from Los Angeles, we have this gas compression plant. It is a natural gas compression plant and natural gas is basically used by over half the people in the United States to heat their homes, they also have natural gas for your stoves, so you are using it a lot. There are a lot of costs and benefits with that, again if you just went with these types of costs and benefits, then you would go ahead – “yes, we are making money off this natural gas”, everybody needs natural gas and they only think about those particular costs and benefits.

But like I said, there are lots of costs and benefits that are missing. So this particular example, the gas industry where basically you are taking the oil out, putting it into tanks and then you are changing it somehow. Hinckley was the compressor station. What a compressor station does is compress all the gas that they have to make it at a higher flow rate, so if you compress it a lot, it is going to cause a lot of heat and causing all this heat, you need something to cool it down. They were using Chromium – they cool the gas down with water but in the tubes they put Chromium to keep all this stuff lubricated and so it would not rust. The problem was Chromium is toxic and they were just dumping it into these unlined wastewater ponds.

If we are thinking about something near Rotorua, say we have forestry and there was a company near there and they dumped their effluent in the forest; it would eventually get into the waterways. From the waterways it would seep into the groundwater system. In Hinckley it leaked from the lakes, leaked from the ponds, went into the groundwater system and then people were ingesting it and getting really sick. My basic point of bringing this up is because a lot of people are familiar with this movie and this is a really great example. What we see is that all the costs were not accounted for. We were not thinking about the health costs of what was put in these unlined ponds. Maybe now you would use something else to lubricate the pipes so they would not get rusty, but that was not thought about in the past and that is the problem.

We have had different problems like that in New Zealand but nothing so dramatic. There have been lots of companies where people have got sick inside the building. I have read about industries that have dumped their by-products into the rivers and the fish have all died. So far there has not been any report of people actually dying from the fish. But there could be and if you know of any examples, feel free to tell me afterwards. I know that there are lots of examples of people getting sick but not directly from something like this.

So all the costs are not accounted for. If we think about things that we can do around all the lakes of Rotorua and around the country, there are lots of different activities that people participate in. These activities are all going to have some type of by-product. You could be going to the lakes to swim and that is really fun, but what about the costs. Are you paying to go to the lake, are we going to the lake for free? People go to the lakes to go boating; you have to pay money for your boat, pay money for petrol. Sometimes the gas and the oil get into the river, so we have to think more about the whole lake. What are we putting into the lake? What are we taking out of the lake? How are we going to keep the lake clean? We have fishing, we have cows near the lake, we have homes near the lakes, and there are lots of by-products in things we have to think about. What quality do we want the lake to be in 50 years? What quality do we want it to be in 100 years?

That is what we are thinking about when we talk about economic values. I am sure that you know a lot more about this than me, but just a couple of examples are water clarity – as we are getting more nitrogen and different chemicals into the lakes, the water clarity is going to get worse. We are not going to be able to see as far into the lakes as we did. Algae bloom is another example, but this is what the ecologists work on rather than me. What I want to talk to you more about is how to value the lakes and what are these economic values? A lot of people ask me why do you use money, why do we have to put everything in economic values and why do we always have to use dollar amounts. I think dollar amounts are really

important to use because everybody understands the dollar amount, everybody needs money to pay the rent or mortgage, and you need to buy food. It is something that we can compare across the whole world. If we think about nitrogen concentration, parts per million of nitrogen in the lake, and you are talking about one lake, then another lake – a lot of people do not really understand and especially Governmental people. But the politicians and people that are going to be making the decisions – they need to understand the reports that they are looking at.

If you wanted to compare the nitrogen concentration with the number of fish in a lake and the number of fish in the lake is really dependent on what lake? How big is the lake? What type of lake? So you can not really say. Fish are not something good to compare either. What about the type of algae that is growing in the lake? Whether it is good algae or bad algae – again that is something that you can compare with lakes but then if you are going to look at the forestry or the picnic table area next to the lake, it does not really go because you can not say “okay, well the algae or the picnic table” and you are going to compare that to the algae in the lake - it just will not work. So that is why we use economic values. That is why we use dollar values, because it is easy to compare and everybody is able to understand it.

#### *Two categories of Values*

- *Market Values*
- *Non-Market Values*

In the past we just talked about market values because we did not consider other things. We did not know – but we have now learned that non-market values are also important. If we start with market values from the lake, the fish that are got out of the lake; commercial fishermen selling them; people going to the lake might pay fees to put the boat on the lake; a special swimming area that one has to pay to go to; anything that you are actually spending money for or people are getting money for. These are market values.

#### *Non-Market Value Categories*

- *Use-Values*
- *Non-Use Values*

This is more complicated and with use values it becomes even more complicated.

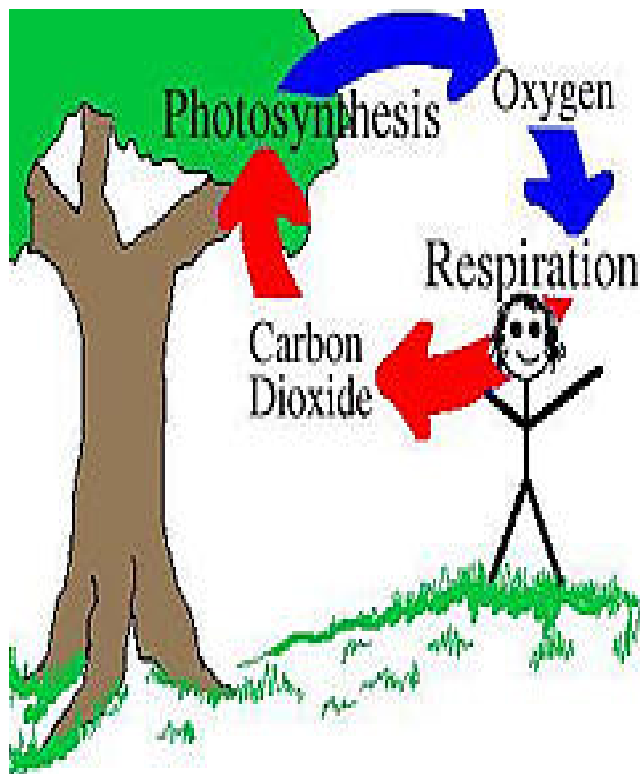
#### *Use Values*

- *Direct use*
- *Indirect Use*

By direct use, you are directly using the resource. You are going to the lake to kayak, fish or swim. You may be going next to the lake to rock climb, you are actually using the lake – direct use. Now indirect uses becomes a lot more complicated and as Robert Costanza was talking about ecosystem service values, there are a lot of ecosystem service values that are indirect uses.



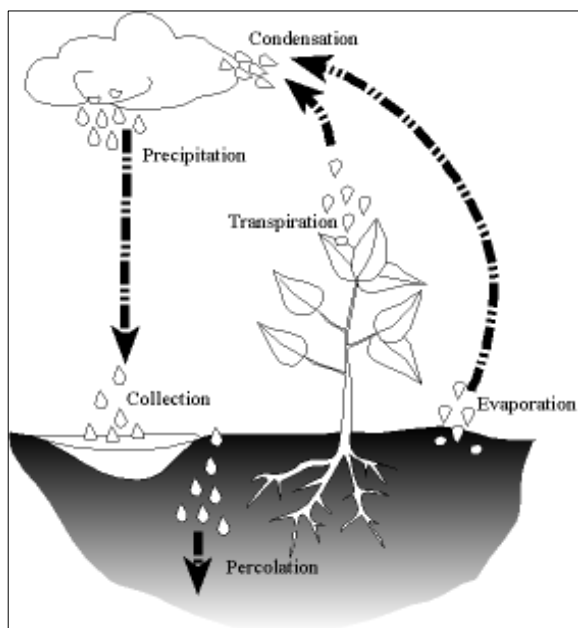
Figure 1. - Indirect Uses



If we look at what is going on in the entire ecosystem (*Figure 1, below*), what can you put values on. The market values of the fish that we are selling would be an ecosystem service value. The trees are photosynthesising and producing oxygen and we are using that oxygen and then we are breathing out carbon dioxide which is going back to the trees. You might not have to go to a park or near the tree that is actually producing the oxygen, the oxygen is in the air. But if we had no trees and we had nothing to photosynthesise, then we would have to produce our own oxygen, so then we would be really stuck. This is an indirect use because we are not going there to use the tree to get the oxygen.

The same thing applies with pest control. There are lots of insects in nature that kill the harmful pests, like the ladybug that eats the aphids off crops. This is a non-direct use – we eat the crops and they get rid of the pests. We are not using that bug directly, but indirectly. There are lots of examples of this.

Figure 2. – Purification of water



The lakes are really good for purification of water and if there are toxins, there are plants in the lakes that can take out some of these toxins. I do not have too many examples (*Figure 2*) but mitigation of floods or droughts – so if we have this particular area here, you can see if there's a big flood, all these plants on the side would get absorbed and would not wash away. Some things would wash away but we need these areas for floods and droughts.

One of the examples I like to use all the time is a parking lot. Imagine we have houses right here beside this piece of land and when it rains, the rain gets absorbed here into the ground. We have no problems; the rain just keeps getting absorbed. Then we decide it is a pain to cut the grass between the houses all the time, let's make it a parking lot or paved area. So we pave over it and now we have all this water that was originally running off and going into the ground but now going into the houses. Now you need a pump to pump the water out of the basement. So everything is related and again we are looking at indirect uses.

Biodiversity is also important. If we get rid of one plant or animal and it was being used by something else, then we are also going to get rid of lots of other plants and animals.

### *Non-Use Values*

- *Existence Value*
- *Bequest Value*
- *Option Value*

Existence value just knows that something exists and you are happy with that. I have never seen a big blue whale, biggest mammal in the world. I may never see one in real life and I do not mind, but I know that it is there and I am happy to know that it is there. So it has an existence value for me. I have met a lot of people in the North Island that have never been to the South Island but they know that there are the Southern Alps and the Milford Sound down there – they are happy just knowing they exist. So that is our existence value.

The bequest value is about future generations – who are going to be following you, what are your grandchildren going to do or if you do not have kids, just the future – other people's children and great-grandchildren. Are they going to be able to go to the Milford Sound some time in the future? As long as it exists, they will. Therefore you are happy to have this bequest value for Milford Sound for people to visit some time in the future, even though you may not ever visit there yourself.

Option value is having the option of being able to go there in the future. Several people that I have met in the North Island have not been to the South Island. They might want to go to the Milford Sound one day and maybe they are saving up vacations until they have enough time, or they do not have enough money right now, but maybe some day will. You have the option to go there some time in the future if you actually do want to see it.

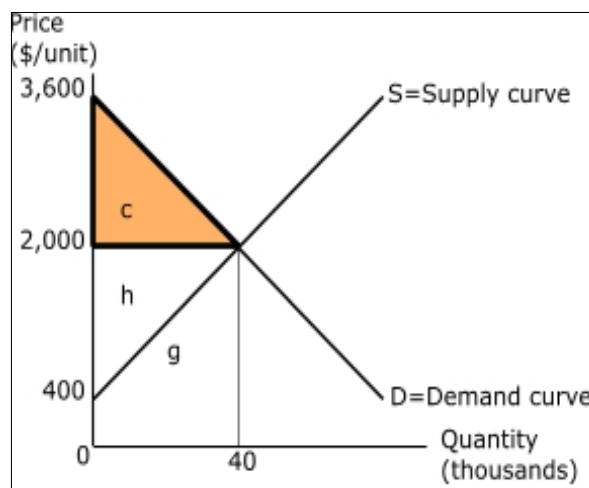
### *Ecosystem Service Values*

- *The conditions and processes through which natural ecosystems and the species that make them up, sustain and fulfil human life.*
- *Can include any and/or all of the above*

We have here one ecosystem, the Rotorua lakes and its catchment area. Think about all the processes that are going on in this particular ecosystem and then we are going to use all these to calculate values for them. We look at both their market values and their non-market values. As I said before, in the past, people only used market values, they did not think about non-market values. But now we realise that we have to calculate them and this is a really difficult task.

What about market and non-market values? This is going to be my most complicated graph (*Figure 3*) that I have for you. If any of you have ever taken economics, supply equals demand, demand equals supply. If we have 40 units that we are going to supply, at \$2,000, our market values here is the “h” and “g”, this area, because this is what we have actually spent. Say we have bought 40 units of land for \$2,000, really cheap, but that would be your market value. The non-market value is what we are trying to get, the consumer surplus value is also what its called, which is “c” and that is the part that you have not spent. So an easy example to think about consumer surplus is if you are going to ski and your lift ticket costs you \$60 but when you get there it ends up being \$30 – “today is a special day, a half price day because it is the owner of the ski field’s birthday”. You spend \$30 but you were willing to spend \$60, so you still have \$30 left in your pocket. That \$30 is your consumer surplus and that is a non-market value – what people are willing to pay.

*Figure 3. – Consumer Surplus*



Now how we get those values is another story. There are lots of different methods but I am going to go over three:-

- *Revealed preference methods- spending money on something to reveal what we would do.*
- *Dated preference method – what we are saying that we are going to do, even though we may or may not actually do it - and what it costs goes into our ecosystem service valuation.*
- *Hedonic pricing - mostly to do with house values or land values*

A basic example of hedonic pricing is if your house was worth \$1,500,000 because it is right next to the lake with a lake view, but the neighbour’s house just across the street from the lake is worth only \$1,000,000 because they can not see the lake. That \$500,000 difference is what is represented in the valuation of the lake. Your ability to view the lake and be next to the lake and go right into it from your property is worth \$500,000 more than it is to live across the street and not be able to see the lake. So with hedonics we think about these economic valuations, what people are paying more for when dealing with land and houses.

The hedonics could be a revealed preference method because you are revealing what you are doing. You are spending money to buy this house or maybe you are not buying that house but you are buying the house next to the lake and that is your revealed preference.

Travel cost is also a revealed preference because it is what you are actually doing but this is more related to recreation. An example would be if I decide to go to the lake from Hamilton, how much money did I spend on petrol to get there? Did I spend extra money to stay in a campground overnight? What extra did I spend, instead of staying home if I wanted to go to the lake and how much more was spent to go there? So that is what we look at with our travel costs.

There are several different types of travel cost methods that we can use, one example is:-

- *Zone 1- the area where the recreation is*
- *Zone 2- people coming from a certain distance away, say 30 km*
- *Zone 3- people might be up to 60km away*
- *Zone 4 - people more than 60km away*

This method looks at how much people are actually paying to go somewhere from different distances.

The willingness to pay method involves doing surveys and asking people how much they are willing to pay. This is also the stated preference method because you are stating what you are going to do. You are not actually going to do it or you might say in the next rates bill, but right now you are not. Brian Bell of Nimmo Bell did a study on the Rotorua area and the Rotorua Lakes and found that the willingness to pay for people to improve the lake water quality was \$91 a year. They were not actually asked to pay this amount of money but they were willing to pay and perhaps that can be considered in their rates. Council could make more money.

Avoided costs are related to ecosystem service values of non-market costs that you are not actually accounting for, something that you are not paying for, but you could be. For example, if you have your grass patch and the water whenever it rains is going down into the grass which is your avoided cost. You do not have to pay to pump it out but if you changed it to this paved parking area and the water was going into your house, your avoided cost is paying for this pumping to get the water out and wherever you are going to pump it to is also going to cost you money. Another example is bee pollination; flowers of all crops that we eat are pollinated either by bees, flies or moths. If we did not have any more bees, we would have to pollinate by hand. So that is another avoided cost, the cost of us pollinating it by ourselves.

So those are all things that we try to calculate to add up our total values. How do our decision makers use this? Let me just give you an example of one of the things that I have worked on. Maungatautari Ecological Mainland Island is located in the North Island not far from here; it is a really neat place where interesting things are happening. So you can see the Island here, (not shown) the mountain, all the forested area, that is all native bush and, just like in Karori, Wellington, they are fencing off this whole area into two separate enclosures. They poisoned all the pests in these areas and are putting in native species.

What is the value of this to us? This is a mainland island, we do not have to go offshore to see and hear kiwi, you can weta, tuatara, and they are also going to put other birds in there. But first they started with kiwi. School groups can go there, we can go there, kiwi are going to be right on the mainland. If there are rodents on the inside of the enclosure, they could get out but the fence will prevent them getting in. The fence is to be 47km long, at a total cost of \$18,000,000 around 3400 hectares. Is that worth it to us to put this up? It is Crown land so people can not be charged to go into the general area, but there will be one into the enclosures for a guided walk. There will also be some treetop tours which can be charged. That is the market value.

My job was to look at all the different types of values that were important to this particular area and calculate the whole ecosystem service area. (*Figure 4*) Market values are the entry charges into the enclosures, charging people to camp overnight, or school groups. People are going to make money in the nearby hotels. There is to be a new campground. All these are market values. The non-market use values are the people going there, using the park, staying overnight, listening to the kiwi and seeing the different birds and tuatara. Their visit is using the resource.

*Figure 4.*

Summary of Total Values after 6 <sup>th</sup> year in operation	
Market Values	Approximately \$3 Million Annually
Non-Market Use Values	Between \$2.2 and \$6.6 Million Annually
Non-Market Non-Use Values	Between \$1.3 and \$2.1 Million Annually
Avoided Costs	Approximately \$5.2 million annually
Overall	Between \$11.7 and \$16.9 Million Annually

We have the non-market, non-use values, which will be different than these avoided costs, more of the bequest value, existence value and the option value – so that's what I am referring to here for the non-market non-use values - between \$1.3 and 2.1 million dollars annually. The avoidance costs which are also the ecosystem service values. So if we were to make it into the paved parking lot that is a very generic example of what would that be worth to us? What about all the birds that are there, birds that are producing offspring that are endangered species, the oxygen that is being produced, the water being filtered and recycled, those values are about \$5.2 million. So if we thought about it the way that we used to think, we would only have about \$3 million that this park is actually worth to us. But if we think about all these other values, the totals are between \$11.7 and \$16.9 million dollars. So we can see if you are adding in all these non-market values, the value is a lot higher than it is by just looking at the market values, and you can see from the other examples that I gave you that it is important.

So just in conclusion, there are lots of benefits and costs to think about but to properly calculate them we have to think not only about the market values, but also the non-market values. Thank you.

## QUESTIONS

*John Green – LWQS:* To do an evaluation of the value of the Rotorua lakes, how long would that take and what sort of cost would be involved?

*Pam Kaval:* Well there are lots of different ways that you can do it. There is one way called benefit transfer. If I were to do a benefit transfer, that would cost less money because I would be taking values that have already been done and applying them to Rotorua lakes. Whereas if I were to do them by myself and that is always best in an ideal situation if there is money and time available to get data specifically for that particular area. So you would have to do a survey of the particular area, talk to different people, survey the general public, survey landowners – and that would cost more money, so I would say the least direct cost is about \$20,000 and the most that it would cost between \$20,000 and \$500,000 depending on how much detail you actually wanted.

*Morgan Williams – Parliamentary Commission for the Environment:* Thank you for that Pam, it is sometimes really good to have it laid out in a way that an ecologist can understand. The thing that fascinates me is how do you bring those talents to the wider picture of how you build up the value story in a region like this. I go back to the energy side of the equation because thinking about resolving the nutrient side, i.e. what we do with that land in a partial forestry or other sense, also has opportunities. Rotorua has declared itself it wants to go carbon-free in energy, so can I pose to you and some of your students that you actually get a piece of work going that looks at the cross over benefits between what Rotorua has declared they want to do as a city and what you could do with this landscape in terms of its energy functions. Because I think one of the things we do not do in trying to solve a problem is look for investment in the opportunities that springs up in a totally different section of society. There you go, that that will keep a few Masters students going for a while!

*Pam Kaval:* That sounds good. There are lots of different things you have got to think about when you are trying to solve the problem. You want to fix the nitrogen and reduce the nitrogen levels, but then you also have to go to where it is actually causing the problem, where the nitrogen is actually coming from. So you have to target the nitrogen that is already there to try to get rid of that, you have to target where the nitrogen is coming from, then you have to think about – like you are saying – with the energy, whether you are going to have houses or some type of power plant, or forestry – it is really complicated. You are right, it is a good thing to think about.

*Sandra Barnes – Environment Waikato:* There are two things about ability to pay that we have seen which are an issue to me, and I think Robert Costanza talked about them a little bit earlier. One is when people are talking about their willingness to pay; they are constrained by how much they know about the subject. When we talk about ecosystem services, for most of us our knowledge of it is severely constrained and if we knew more, we might be willing to pay a great deal more. The second thing that concerns me is that we are also constrained by

how much money we have and so depending on the population where the problem is, for instance if we talked about air quality in Tokoroa, the willingness to pay by the population might be quite low and yet the problems really are quite immense. What are your thoughts on that?

*Pam Kaval:* Well, willingness to pay is based on what you can actually pay. Some people in a particular area can not pay much because they do not have much. But if it is something like, say Maungatautari, that is important to the whole country to preserve an endangered species maybe people in the immediate area are going to value it more because they could put up a campground and charge people to go there, or walk there and enjoy the wild life. They would have a higher value but that does not mean that people further away do not value it. Maybe they might say, "I'm not familiar with Tokoroa" so their total willingness to pay could be lower than the Tokoroa people. But if it was something important to the whole country, people from further away might have more money so they might be willing to pay more than people in Tokoroa just because they have more. So it is a complicated issue because you not only have to think about what is going on near you, but also what is going on further away.

To answer the other part of the question – with the limited knowledge, when you are doing surveys, you are presenting somebody with the situation and you are not trying to get them into a biased situation, you are just trying to present it as it is. So you are going to say "this is the lake and the lake is important because it provides nutrients for the fish that grow in the lake". This is just a really general example. "How do you use the lake?" "How do you feel about it?" But with the avoided costs, that is something that is not included in the non-market use, non-market non-use, but it is a separate type of cost and people are not as aware of that, because they do not have as much knowledge about it. That is something you have to calculate totally separately, that is not calculated in surveys. You have to calculate it with the values of particular trees and oxygen production, like if you are thinking about the avoided costs, about say, the bees pollinating. How much would it cost for you if those particular bees from this particular area are going to go out, say 3km in distance. So if you had to pollinate all these plants within 3 km, how much would it cost to do that individually? But then we have to think about not only the bees, we have to think about all the other ecosystem services too.

So it is pretty complicated and I tried to make it really general for you so you get the concept and understand it. But it is really hard to calculate these values and it does take a lot of time.

*Bahari Chong – Phoslock:* Pam I would just like to hear your thoughts on the value of time, you know when we are talking saving our lakes, because to me - like depreciation of cars for example, if you have a cost of a car and over a number of years that you run it, it depreciates, but if you do not spend the money to maintain it, then obviously the depreciation is going to be worse. So can we apply that sort of model to our lakes?

*Pam Kaval:* Well we are trying to account that also, but that is even more complicated. A lot of things deal with time now and we seem to be an "I want it now society". You are going to the store and you want all these things right now, and you do not want to wait until next week to get this new car or television. So I think that we have to start thinking differently. It is not going to happen right now of course, but people are going to have to change. In the past when they built pyramids or a big cathedral it took hundreds of years, and used thousands of people.

But that was okay because what they built was really high quality and lasted. When I visited my uncle in Germany, their houses were built to last for hundreds of years. My house in Colorado is not built as well, it will probably last a couple of hundred years, not a thousand years.

I believe we have to start thinking differently and that is going to take a lot of time in itself. People realise things take a long time, we are not going to clear up the Rotorua lakes or Lake Taupo overnight because the stuff that is going in now happened thirty years ago. So what has happened within the past 30 years is going to build up and affect Rotorua for many years yet. If we stopped completely today, we are still going to have these effects in the future. We do have to start thinking more long-term, but we also have to think about what we are doing now. It complicates the formula that can be done, but it takes more time.



# **The Benefits of Restoration and the Cost of Doing Nothing from the Canadian Perspective**

Marion Robinson  
*Manager Fraser Valley, Fraser Basin Council  
British Columbia*

*Marion is a professional facilitator and comes from a bush pilot and farming background. Her accomplishments include precedent setting models of cooperation in culturally significant sites; initiating nutrient management planning strategies; developing restorative justice programmes and new models of enabling watershed stewardship; working with agriculture as a community development vehicle towards sustainability, and stimulating business communities to take environmental actions. Marion is always working on effective change.*

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## **ABSTRACT**

The Fraser Basin Council (FBC) is a Canadian non-government, not-for profit organization established in 1997 to advance the sustainability of the Fraser River Basin in British Columbia. The FBC brings together government with private sector and civil society interests to find common ground and develop enduring “made-in-the-community” solutions to regional and Basin-wide sustainability challenges.

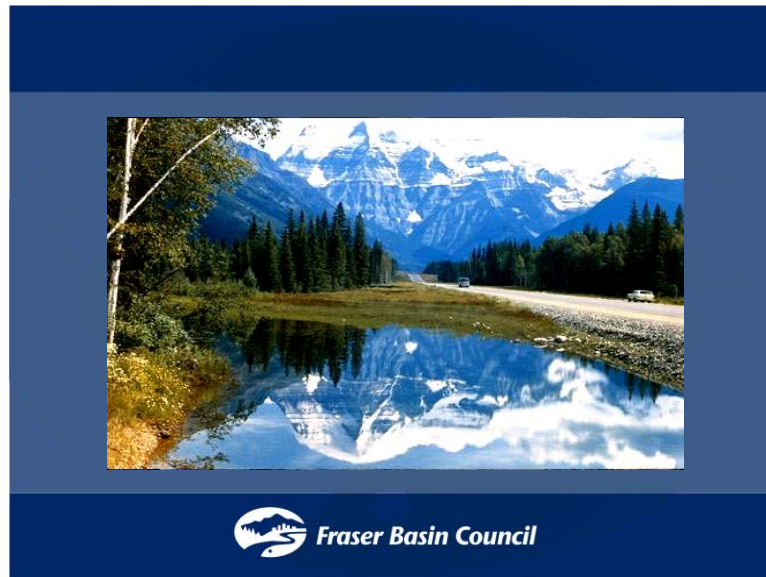
The FBC’s success at addressing many difficult and long-standing issues stems from a new kind of collaborative leadership that emerges when diverse interests coalesce around core values, and when consensus and joint action are chosen over confrontation, litigation or inaction.

Fraser Valley Manager, Marion Robinson, will present the progress made regarding agricultural nutrient management and some not-so-secret ways to inspire human understanding and actions.

## **1. Introduction: The Fraser Basin Council**

The Fraser Basin Council (FBC) is a non-government, not-for profit organization established in 1997 to advance the sustainability of the Fraser River Basin. The FBC brings together government with private sector and civil society interests to find common ground and develop enduring “made-in-the-community” solutions to regional and Basin-wide sustainability challenges. The FBC’s success at addressing many difficult and long-standing issues stems from a new kind of collaborative leadership that emerges when diverse interests coalesce around core values, and when consensus and joint action are chosen over confrontation, litigation or inaction.

The Fraser Basin Council currently has more than 50 projects underway from flood mitigation to international outreach. See more at **[www.fraserbasin.bc.ca](http://www.fraserbasin.bc.ca)**



## 2. The Fraser River Basin

British Columbia's Fraser River Basin—it's unsurpassed in natural grandeur, human diversity and economic opportunities. Covering some 240 000 km<sup>2</sup> or roughly one-quarter of BC, nearly 90% of New Zealand could easily fit into the basin (New Zealand is 268 000 km<sup>2</sup>). The Fraser Basin stretches 1400 km from the Rocky Mountains to the Pacific Ocean, is the fifth largest drainage area in Canada, and is home for two out of three British Columbians.

The Fraser Basin is the geographical area drained by the Fraser River and its thirteen main watersheds. The vast and intricate network of tributary rivers, lakes, streams, marshes, bogs, swamps, sloughs and waterways spreads like a system of veins through the heart of the province, flowing into the Fraser, the principal artery, from more remote districts. If the Basin is the heartland of British Columbia, then the Fraser and its tributaries are its lifeblood.

A journey down the magnificent Fraser River begins on Mount Robson, the highest peak in the Rocky Mountains. On its way to the sea, the mighty Fraser passes through five dramatic climatic zones: from alpine tundra and pine forests, to grasslands and desert-like canyons, through old growth rain forest and a fertile, lowland valley.

The Fraser Basin boasts one of the world's most productive salmon river systems, supporting five salmon species and 65 other species of fish, including steelhead and giant sturgeon. The Fraser River and its tributaries comprise BC's most productive waterfowl breeding and overwintering area, and a crucial staging area on the Pacific Flyway for massive flights of migratory birds. The mouth of the River in particular is recognized as a globally significant estuary. Hundreds of species of birds, reptiles, amphibians and mammals, not to mention trees, plants and insects, form the basis of the Basin's diverse ecosystems.

The Basin's key assets are its people, culturally diverse and educated, in a tolerant, open society, blessed with abundant resources and still relatively healthy ecosystems. Together, this vast ecosystem is home today to 2.7 million British Columbians. That number is projected to rise to four million over the next two decades.

The aboriginal peoples (Sto:lo, Nlaka'pamux, Secwepmec, Stl'atl'imx, Tsilhqot'in, Carrier and Okanagan-speaking First Nations) were the first to recognize its special nature and enjoy its bounty. Archeological evidence confirms oral traditions that their ancestors have lived beside the river since the vast glaciers starting receding 10 000 years ago and the Fraser River, as we know it, was born. Some 70 000 aboriginal people in 91 First Nations Bands currently live in the Basin.

Over the past two hundred years, people from all over the world—first from Great Britain/Hawaii, Europe and North America, then from China, Japan and India and most recently from other parts of Asia, Latin America, the Middle East and Africa—have come here to live, work and play. In Vancouver alone, 70 different languages are spoken.

The Fraser Basin contributes 80% of the provincial economic output and 65% of total household income. It contains 210 000 km<sup>2</sup> of forest, or 78% the land area of New Zealand. Half of BC's farms are in the Basin. Eight major mines in the Basin account for 60% of BC's metal mine production. In addition, some of the provinces—and the world's—most spectacular natural beauty and recreational opportunities abound in this area, contributing 67% of total tourism revenue.

### **3. The Significance of Agriculture in British Columbia**

BC is a very mountainous province and the best farmland in the valley bottoms is also the best land for other human uses. With a population of 4 million people, BC grows half its food (net figure) on 5% of its land base. By comparison 12% of the land base is designated as parks. Agriculture in BC is unique in the world for the following reasons:

- So many people are sustained from a small agricultural land base.
- BC is a world leader in niche markets such as tomatoes, tree fruits, berries, ethnic foods.
- British Columbia's agricultural products generate receipts to farmers of more than \$2.2 billion each year.
- More than 200 different commodities are produced on about 22 000 agricultural farms.
- 95% of farms are family owned (not vertically integrated where the farms are part of larger corporate holdings.)
- Agri-tourism is the fastest growing sector of the \$9 billion dollar tourism industry.
- 25% of BC's agricultural economy is in Small Lot Agriculture.
- The dairy industry is the largest single component of the agriculture industry in terms of assets and annual revenues.
- Crops of major economic importance to BC include floriculture and nursery, berries and grapes, and tree fruit.
- The agri-food industry generates about 260 000 jobs for British Columbians directly and indirectly, nearly 14% of the province's employed labour force.
- For more info: <http://www.agf.gov.bc.ca/aboutind/index.htm>

#### 4. Fish and the Fishery

Now to compare another sector...

The Fraser River is one of the largest and most significant salmon bearing systems in the world. BC's farmland and urban expansion, however, often encroach on watersheds important for fish habitat. Therefore, very careful land management is needed to ensure the sustainability of food systems for both fish and people.



Fish have returned and brought nutrient to the Basin for millennia. The fish cycle ensures the well-being of the ecosystem, from large mammals, and trees<sup>1</sup> (forestry sector), to the most minute forms of life.

The Canadian fishing industry is one of the most valuable in the world, generating five billion dollars a year and providing more than 120 000 jobs. The Pacific fishery accounts for 16% of total landings, with top production in hake, Pacific herring, redfish, and salmon.

There are 18 major fish hatcheries in the province of British Columbia. Since 1975, half a billion dollars has been spent on Pacific Salmon enhancement. Despite this expenditure the salmon populations declined province-wide. Even the successfully hatched young salmon do not reach maturity. By 2001, catches had declined from historic annual average hauls of 60 000 metric tonnes to less than 20 000.

In 1999, Canada and the United States signed the Pacific Salmon Treaty, a conservation-based approach to the management of the Pacific salmon fisheries, and a more equitable sharing of salmon catches between the two countries.

#### 5. Sustainability and the Issue of Balancing while Protecting

Here we focus on the human element in the complex issue of balancing diverse interests while protecting the environment.

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<sup>1</sup> The Salmon isotope N15: 55% of this nitrogen isotope, which was present in core samples taken from stream-side trees, originated in salmon. Not only was N15 elevated in some trees, but it also rose and fell depending on salmon abundance.

First let's look at the nature of solutions.

A. Solutions have three inherent parts<sup>2</sup>:

- i. Structural Response: legislation, guidelines, rules.
- ii. Technical Response: science, research, knowledge.
- iii. Cognitive response: mind-set, creating political will and understanding, getting people to take action. This is where the FBC spends the most time, helping to foster change.  
If human will is not present in the process, then even legislation will not be adhered to.

## **6. The Cognitive Response**

Working with people and increasing the number of supporters is very effective. There are many approaches, some more suitable than others. Traditionally a public process involves a public hearing in a large hall where Council (or the authority) sits at the front and takes speakers at the microphone. Usually, dialogue and the opportunity to be curious is lacking (see Appendix 1). People tend to polarize into “for and against” points of view. The authority simply records all that is said and makes decisions in private. This model does not inspire participants or authorities to move from a positional point of view to a more interest-based point of view. The pathway to working together is stilted.

### **Other Approaches**

Another common approach is to design a public process, as outlined in Appendix 2. Facilitation tools may include traditional problem solving approaches such as

- Gap Analysis or SWOT, (strengths, weaknesses, opportunities, threats)
- Planning from different approaches (traditional or issue-based).
- Appreciative Inquiry

Appreciative Inquiry (AI) is a strength-based approach that answers the questions, “What gives life to an organization?” and “What is working in an organization?” This approach is being used today by leading business schools.

Appreciative - means to value.

Inquiry - is the process of seeking to understand through asking questions.

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<sup>2</sup> Dr. Lauren Owens, 2001, BC Ministry of Agriculture, now with Agriculture and Agri-foods Canada.

## A Comparison of Problem Solving with Appreciative Inquiry

<i>Problem Solving</i>	<i>Appreciative Inquiry</i>
<ul style="list-style-type: none"><li>• Identification of Problem</li><li>• Analysis of Causes</li><li>• Analysis of Possible solutions</li><li>• Action Planning (Treatment)</li></ul>	<ul style="list-style-type: none"><li>• Appreciating and Valuing the Best of What Is</li><li>• Envisioning “What Might Be”</li><li>• Dialoguing “What Should Be”</li><li>• Innovating “What Will Be”</li></ul>
Focuses on the Past	Focuses on the Future
Basic Assumption: An organization is a problem to be solved.	Basic Assumption: An organization is a mystery to be embraced.

See Appendix 4 for further details on AI.

### **Additional Comments**

For most people, it is generally clear what needs to get done. The challenge is usually how to get it done.

Other than good process design and adjusting as necessary, the following are some added thoughts about ensuring success:

- Human hands and understanding create the difference
- “The significant problems we have cannot be solved at the same level of thinking with which we created them” (Albert Einstein)
- Change takes time
- Use (or create) a catalyst, facilitator and conflict resolution agent to:
  - Design the process (may be a parallel process at first)
  - Engage mavens/connectors<sup>3</sup>, and decision-makers
  - Undertake the project of creating positive change
  - Use monitoring, adaptive management
  - Continue ongoing effort.

## **7. Example Project: Mitigation of Nutrient Loading in Sensitive Watersheds**

### **Environmental Farm Planning**

Issue: In the mid-90s environmental enforcement agents and farmers were struggling with which actions need to be taken to mitigate nutrient impacts to soil and water in the Fraser Valley.

Agriculture produced a position paper and supported the Right To Farm Act, while the ministries enforced the Waste Management Act and audited and charged farmers that were in non-compliance. Tensions were high.

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<sup>3</sup> Recommended reading: *The Tipping Point* by Malcolm Gladwell. Gladwell defines mavens and or connectors as key ingredients for change. A maven is an extremely well connected person, a local champion or opinion-maker, with some sales ability.



The Fraser Basin Council was asked to facilitate a planning strategy for nutrient management<sup>4</sup> with the support of the BC Agriculture Council, the BC Ministry of Agriculture and the BC Ministry of the Environment. From 1999 to 2001, the FBC designed a process that convened commodity groups and government agencies, and encouraged progress from groups as diverse as senior governments and individual farmers. During this effort many streams of action made significant progress.

This progress included the following:

- Sustainable Manure Management Program, (based on incentives) largely with dairy and poultry groups even though the horticulture sector was included. Results included \$12 million spent on expanded manure storage to ensure that the timing and quality of manure application could be best managed. Spreading manure during the high rainfall winter months is illegal so increased manure storage was the key tool. Incentive funding such as this required approval from the Federal Minister of Agriculture.
- Better information became available to commodity sectors. Raspberry producers benefited from research<sup>5</sup> that found that more is not better and that farmers saved money by not applying excess fertilizer to their crop.
- Sustainable Poultry Farming Group<sup>6</sup>: Poultry groups are now transporting manure from the sensitive Abbotsford Sumas Aquifer to nutrient-poor hay fields in the interior of BC, resulting in increasing hay production. On the return journey, trucks are loaded with wood chips bound to market, making the exchange economically feasible.
- Government and industry together established the Environmental Farm Planning (EFP). This planning framework is significant as it provides standardized farm self-audits and reporting, and allows commodity groups to report as a whole. Also, the self-audit helps prioritize environmental actions on-farm, and incentive funding stimulates environmental actions. (See Appendix 3 for further information on EFP.)



<sup>4</sup> Nutrient Management Planning Strategy. 2001 click publications, [www.fraserbasin.bc.ca](http://www.fraserbasin.bc.ca)

<sup>5</sup> Dr. Grant Kowalenko, Pacific Agri-Research Canada, Agassiz, BC

<sup>6</sup> <http://www.sustainablepoultry.ca/>



At the same time the BC Government has changed it's approaches from pure enforcement to a more collaborative approach in an effort to get more non-compliance cases to come into compliance. As an example of this changing attitude within government, George Rushworth, an Environmental Protection Officer with the BC Ministry of Environment in Surrey, BC, gave the following comments:

*“When I took on the Agriculture portfolio I realized that due to a change in resources I had to look at alternatives. In the past, ministry staff addressed each complaint and tried to visit the farm. Visits were usually of an enforcement nature and tone. I'm not sure we would have the success we are having now without the previous enforcement action. Now we are focusing on the following:*

- We now use risk management when addressing complaints. This process looks at both the hazards and consequences when considering danger to human health and the environment.*
- Some complaints are addressed with a phone call to try and initiate some action. If this does not appear to work a visit may be necessary depending on the risk to human health and the environment.*
- We now try and take a shared approach to the responsibility for the environment with industry BC Chicken Marketing Board, BC Milk Producers Association, BC Pork Producers Association, etc. and other Ministries i.e. Ministry of Agriculture and Lands. We may call on these agencies and association and ask them to address the environmental concern and ask them to report back.*
- Use enforcement as a last resort i.e. when there is a large discharge or there is a history of non-compliance.*

We also have looked at alternatives on how best to effect change in the producer's behaviour when addressing complaints. To achieve a change in behaviour we considered some of the following:

- We will be more likely to achieve change if the producers understand the importance of the need to protect the environment and want to change i.e. the producers buy in to the idea of environmental protection.*
- Producers may be more interested in protecting the environment and make the necessary changes to their practices if they have a positive attitude towards the ministry staff. Therefore we make an effort to treat producers fairly and with respect i.e. choose your words carefully and acknowledge the producers point of view.*
- Use public perception when possible. Suggest to the producer how certain non-environmental friendly action may be perceived by the public.*



I hope this information is of assistance to New Zealand. Also special greetings to Dr. Morgan Williams.”

- George Rushworth

## 8. Lessons Learned: Benefits of Restoration and the Cost of Doing Nothing

- a) Natural capital: This idea places actual monetary value on the goods and services that natural systems provide to humanity. Natural systems, then, are compared to financial capital which, if lost, can no longer provide positive returns on investment. Healthy natural capital can provide numerous benefits, such as: improved water quality and therefore lower water treatment costs; lessened flood hazards; and better recreation opportunities. Though natural capital is continually being destroyed in BC’s Lower Fraser Valley, its protection could save residents at least hundreds of millions of dollars every year<sup>7</sup>.
- b) Key ingredient to success: The value of public involvement. One of the cornerstones of democracy is the idea that citizen participation is essential to good government.



### What does public involvement aim to accomplish?

Public involvement engages citizens, community groups, organizations, and businesses in problem solving, planning and decision-making at both Council and staff levels. Public involvement processes are designed to

- inform citizens, groups, and organizations about specific decisions likely to affect their lives;
- ensure all views are considered in planning and decision making;
- create joint visions that speak to multiple interests and concerns;
- initiate action to resolve issues and problems.

*“Above all, public involvement processes aim to inspire people, groups, and organizations to take an active role in caring for and enriching their community. Doing so builds the longer-term capacity of the city and its citizens to work together for a healthier, safer and more vibrant community.”*<sup>8</sup>

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<sup>7</sup> Olewiler, N. (2004). *The Value of Natural Capital in Settled Areas of Canada*. Published by Ducks Unlimited Canada and the Nature Conservancy of Canada. 36p.

<sup>8</sup> Michael White, Planner, From the City of Vancouver web site (2006). <http://www.city.vancouver.bc.ca>

Problems that can make the public involvement process fail:-

- lack of access to information
- lack of including community groups (bringing folks in when the decision is already made)
- lack of facilitation (i.e. moving folks from being positional to interest based)
- inconvenient and time-consuming meetings
- confusing terms and graphics
- one-way communication.

## 9. Conclusion

Certainly every geographical area has its own unique groups competing for limited resources. This often strains land availability, cultural values, and natural ecosystems which struggle to adapt to human encroachment. Though often taken for granted and subsequently degraded, these natural systems not only support vulnerable forms of life, but they also provide people with numerous benefits. These benefits, such as flood and erosion control or clean water and air, would be extremely expensive to purchase were the natural system to collapse. Worldwide, societies face the demise of their region's natural capital without recognizing the true cost to themselves of their choices.

The Fraser Basin Council demonstrates the success that a third party can have in facilitating between opposing interests in complex areas of conflict. The FBC brings process expertise, a fresh point of view, and a desire to work with all parties to find creative solutions. Problems are analyzed from each side of a conflict, and areas of agreement and common interest are used to build solutions. For example, in an industry/government conflict, the FBC may focus on the core objectives of government regulations rather than specific regulations themselves. From industry's perspective, the FBC may look at what technical, economic, or other factors make it difficult to meet government regulations. Could some of the government funds directed at legal enforcement yield better returns if spent on helping industry reduce emissions where expense is a limiting factor? Is it possible that industry's presuppositions are mistaken and that reducing emissions in some cases might actually make economic sense? The keys to successful resolution of land-use conflicts include collaborative leadership, finding common ground, and public involvement.

### **When nature is destroyed, society loses these benefits**

- Good quality surface and groundwater
- Ability to reduce water and waste treatment costs
- Aesthetic and recreational opportunities
- Protecting agricultural production on lands threatened by urbanization
- Ability to decrease net greenhouse gas emissions
- Ability to mitigate floods
- Ability to improve air quality by protecting forests and reducing urban sprawl
- Protecting and enhancing habitats and ecological services of all kinds

## APPENDIX 1

### **Debate Versus Dialogue**<sup>9</sup>

<b>Debate</b>	<b><u>Dialogue</u></b>
Assuming there is a right answer and you have it.	Assuming that many people have pieces of the answer and that together they can craft a solution.
Combative: participants attempt to prove the other side wrong.	Collaborative: participants work together toward common understanding.
About winning	About exploring common ground
Listening to find flaws and make counter-arguments	Listening to understand, find meaning and agreement
Defending assumptions as truth	Revealing assumptions for re-evaluation
Critiquing the other side's position	Re-examining all positions
Defending one's own views against those of others	Admitting that other's thinking can improve on one's own.
Searching for flaws and weaknesses in other positions	Searching for strengths and value in others' positions
Seeking a conclusion or vote that ratifies your position	Discovering new options, not seeking closure as the prime goal.

## APPENDIX 2

### **Sample Public Engagement Plan list**

#### **1. Informing and Engaging People Through Outreach and Organization**

- A. Identify and bring a core participation group together
  - Civic or regional advisory committees
  - Citizens on decision and policy bodies
  - Collaborative task forces
  - Decision-makers.
- B. Consider including a diversity of people such as: First Nations, the business community, commodity groups, ethnic groups, minorities, and low-income groups, and people with disabilities.
- C. Provide information and establish methods of communication such as: mailing lists, public information materials, key person interviews, briefings, video techniques, telephone techniques, media strategies, speakers' bureaus, and public involvement volunteers.

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<sup>9</sup> From *The Magic of Dialogue, Transforming Conflict Into Cooperation* by Daniel Yankelovich, Simon and Shuster 1999. ISBN 0-684-86566-1. c Viewpoint Learning Inc. (see [www.viewpointlearning.com](http://www.viewpointlearning.com))

Consider technology for surveys and decision making.<sup>10</sup>  
(Sometimes there is a need for a parallel process.)

## 2. Involving People Face-to-Face By Convening Meetings

- A. Determine the type of meeting
  - Consider the meeting culture (businesses or farmers?)
  - Public meetings/hearings, Open houses/open forum hearings,
  - Conferences, workshops, and retreats.
- B. Select an organizing feature for a meeting
  - i.e., Brainstorming, Charrettes, Visioning, Small group techniques, Appreciative Inquiry approach

## 3. Receiving Feedback from Participants

- A. Establish places people can find information and interact
  - Determine the communications culture: what works and why.
  - I.e. On-line services, Hotlines, Drop-in centers
- B. Design programs to bring out community viewpoints and resolve differences. I.e. Focus groups, Public opinion surveys, Facilitation, Negotiation and mediation, Appreciative Inquiry Approach

## 4. Use Special Techniques to Enhance Participation

- A. Hold special events, (include food), Themed fairs, Games and contests
  - Create a sense of ownership and involvement.
- B. Change the meeting approach to Improve meeting attendance
  - Hold meeting at other venues. Ask groups to host.
  - Consider Role playing, Site visits, Non-traditional meeting places and events.
- C. Find new ways to communicate
  - I.e. Interactive television, Interactive video displays and kiosks
  - Computer presentations and simulations, Teleconferencing
  - Theatre Forum, interactive theatre<sup>11</sup>

## **APPENDIX 3**

### *Environmental Farm Planning*

Source: Ron Bertrand, BCAC Draft brochure, February 2006

#### *What is environmental farm planning?*

Environmental farm planning is a voluntary process that producers can use to identify both environmental strengths and any potential risks on their farms. As appropriate, it includes a prioritized action plan to reduce the risks.

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<sup>10</sup> <http://www.americaspeaks.org/> America Speaks engages citizens in the public decisions that impact their lives. America Speaks is developing a national infrastructure for democratic deliberation that institutionalizes the links between decision-makers and citizens in determining public policy.

<sup>11</sup> See <http://www.headlinetheatre.com/>

### *Ensuring a consistent, national approach to environmental farm plans*

Agriculture and Agri-Food Canada (AAFC) has developed a national approach on how environmental farm plan (EFP) programs are to be developed and implemented across Canada. Through the national EFP program, a set of national principles are used to ensure EFP programs are administered consistently on a province-by-province basis.

This national approach to EFP programs will bolster Canada's reputation as a grower and supplier of safe, high-quality foods that are produced in an environmentally responsible manner. While the approach is national, its flexibility takes into account regional, geographical, and climatic differences.

### *Why do we need environmental farm planning?*

Consumers increasingly base their buying decisions on a desire to support environmental sustainability. Producers have shown they are admirable stewards of Canada's agri-environmental resources—they apply many good environmental practices that increase their profitability and benefit the environment.

Working together under the Agricultural Policy Framework, governments and industry are looking to accelerate efforts to reduce agricultural risks and provide benefits to Canada's water, soil, air, and biodiversity resources. Environmental farm planning is the foundation of that approach.

### *The Canada–British Columbia Environmental Farm Plan Program*

The Canada–British Columbia Environmental Farm Plan Program complements and enhances the current environmental stewardship practices of producers. Led by the province's agriculture and agri-food industry, this initiative encourages producers from all parts of the province to adopt beneficial management practices (BMPs) that enhance agricultural sustainability and contribute to a cleaner, healthier environment.

The program applies to all types and sizes of farm operations throughout the province. As participants in this program, producers are able to identify their farm's environmental strengths, prioritize any potential risks to the environment, and take advantage of tools and techniques available to manage those risks. Producers who develop and have a completed EFP become eligible to apply for cost-shared incentives through the National Farm Stewardship Program (NFSP) and Greencover Canada to implement actions identified in their plan.

### *Who is eligible?*

All British Columbia agricultural producers who own land assessed "farm" by the BC Assessment Authority and who hold a current federal Business Number.

### *Who delivers the program?*

The British Columbia Agriculture Council (BCAC) delivers the program on behalf of AAFC, and in co-operation with Fisheries and Oceans Canada, Environment Canada, and the British Columbia ministries of Agriculture and Lands (BCMAL) and of Environment (BCMoe).

EFP planning advisors, with assistance from BCAC, AAFC, BCMAL, and other agency partners, provide producers with technical support to help them prepare and implement their environmental farm plans.

#### *British Columbia Agriculture Council Principles*

BCAC, in co-operation with AAFC and BCMAL, is committed to making sure that the EFP process in British Columbia:

- is driven by producers;
- encourages voluntary participation;
- assures EFP confidentiality; and
- encourages producers to implement their EFP action plans by providing funding that is directed to support on-farm actions to reduce agri-environmental risks.

By adhering to these principles, the EFP program in British Columbia strives to:

- improve the sustainability of the province's agricultural industry;
- recognize producer efforts to manage their land in an environmentally sustainable manner;
- improve farm profitability;
- improve awareness;
- enhance marketing opportunities;
- improve the response to environmental incidents through contingency planning;
- demonstrate on-farm due diligence;
- reduce the need for additional environmental regulation; and
- improve relationships with environmental agencies.

#### *The "Delivery Group" approach*

In British Columbia, delivery groups lead the delivery of EFP services at the local level. Delivery groups—farm organizations selected through an application process—co-ordinate the delivery of EFP programs to commodity groups and to producers in certain geographic areas.

Delivery groups secure the services of recognized EFP planning advisors. To be recognized by BCAC, planning advisors have successfully completed an intensive training program. Through small-group workshops or one-on-one meetings with producers, EFP planning advisors help to identify strengths and concerns, suggest appropriate corrective measures, and help prioritize any action items. EFP planning advisors are responsible for ensuring environmental farm plans are complete, and help producers access incentive funding.

#### *How does the program work?*

Producers participate in the program by:

- attending a workshop or a one-on-one session with a planning advisor;
- conducting a risk assessment of their farm or ranch, alone or with a planning advisor's assistance;
- developing a plan to mitigate any identified risks; and
- having a trained and recognized EFP planning advisor ensure the plan is complete.

#### *Performing a risk assessment using the planning workbook*

By conducting a risk assessment, producers establish the current level of environmental health-related risks to various activities on their farm or ranch. This is accomplished using a specifically designed planning workbook, which the EFP planning advisor provides. The results of the assessment identify areas of concern on the farm or ranch that the producer may need to address to reduce environmental risks.

#### *Developing an action plan*

With a completed planning workbook, and with the help of an EFP planning advisor, the producer develops an action plan to decide on the next steps required to manage the identified risks, and to determine the priority of the action items. EFP planning advisors are available to help establish priorities, develop potential on-farm solutions, and approve the finalized environmental farm plan.

#### *What financial benefits are available?*

When an EFP planning advisor has ensured the environmental farm plan is complete (by issuing a Statement of Completion), the producer is eligible to apply for cost-shared incentives under the National Farm Stewardship Program, Greencover Canada, and other funding partners. Through these programs, producers have access to cost-shared funding to implement eligible BMPs that address environmental risk priorities identified in the plan, under such categories as:

- nutrient management improvements;
- riparian protection;
- grazing strategies;
- irrigation planning;
- wildlife issues;
- integrated pest management;
- shelterbelt development; and
- biodiversity enhancements.

#### *Who can apply?*

To apply for incentive funding, producers must have a Statement of Completion issued by a planning advisor, or must have participated in an Equivalent Agri-Environmental Plan (EAEP).

#### **Note**

Any projects a producer starts before receiving both an approved EFP and a project proposal are not eligible for funding. In addition, the project must be completed and operational before claims can be reimbursed.

#### *For more information*

For more information on the Canada–British Columbia Environmental Farm Plan Program, please visit [www.bcac.bc.ca/efp\\_programs.htm](http://www.bcac.bc.ca/efp_programs.htm)

For more details on the Agricultural Policy Framework (APF), please visit the AAFC Web site at [www.agr.gc.ca](http://www.agr.gc.ca) for details.

## APPENDIX 4

### *Appreciative Inquiry (AI)*

Source: <http://appreciativeinquiry.case.edu/>

In the years since the original theory and vision for "Appreciative Inquiry Into Organizational Life" was articulated by two professors at the Weatherhead School of Management there have been literally hundreds of people involved in co-creating new concepts and practices for doing AI, and for bringing the spirit and methodology of AI into organizations all over the world. Commenting on her assessment of AI's uniqueness, a senior executive at one company recently said: "I know what AI is about...it is about creating a positive revolution in change." And in words that echo the same thing, University of Michigan Professor Robert Quinn, in his acclaimed book *Change the World* writes: "Appreciative Inquiry is currently revolutionizing the field of organizational development."

#### *What is AI?*

Appreciative Inquiry is about the co-evolutionary search for the best in people, their organizations, and the relevant world around them. In its broadest focus, it involves systematic discovery of what gives "life" to a living system when it is most alive, most effective, and most constructively capable in economic, ecological, and human terms. AI involves, in a central way, the art and practice of asking questions that strengthen a system's capacity to apprehend, anticipate, and heighten positive potential. It centrally involves the mobilization of inquiry through the crafting of the "unconditional positive question" often-involving hundreds or sometimes thousands of people.

In AI the arduous task of intervention gives way to the speed of imagination and innovation; instead of negation, criticism, and spiralling diagnosis, there is discovery, dream, and design. AI seeks, fundamentally, to build a constructive union between a whole people and the massive entirety of what people talk about as past and present capacities: achievements, assets, unexplored potentials, innovations, strengths, elevated thoughts, opportunities, benchmarks, high point moments, lived values, traditions, strategic competencies, stories, expressions of wisdom, insights into the deeper corporate spirit or soul-- and visions of valued and possible futures.

Taking all of these together as a gestalt, AI deliberately, in everything it does, seeks to work from accounts of this "positive change core"—and it assumes that every living system has many untapped and rich and inspiring accounts of the positive. Link the energy of this core directly to any change agenda and changes never thought possible are suddenly and democratically mobilized.

Read the complete excerpt from *A Positive Revolution in Change: Appreciative Inquiry* by David L. Cooperrider and Diana Whitney.

## QUESTIONS

*Steve Chadwick, MP:* Thank you Marion. Just a question about the instigation of the Council, did that come from a community-mindset about Local Authorities and Central Government not taking enough interest?



*Marion Robinson:* Thank you for asking that. Here's the quick story. In 1991 the Fraser River was suffering from the pollution that comes from pulp mills dioxins and leaches. At the same time the City of Vancouver was not doing very well in sewage treatment. So the then Mayor of Vancouver, who is now our Premier, Gordon Campbell, challenged the then Mayor of Prince George, saying clean up the river – and the short answer is they did. Vancouver put in the largest capital project in Canada at the time, a sewage treatment plant, and the river from Cowes to Prince George cleaned up the pulp mill process. It was a Government body at the time called the Fraser River Management Board. When it completed those projects, it was decided by some that the Board was not needed any more, but others felt that it was valuable, but not as a Government body. So it was reincarnated in 1997 as the Fraser Basin Council, being more citizen-driven non-profit; the visionary was our Lieutenant Governor, Iona Kalpanolo. She sent us out to do what she calls God's Work and she reminded us to take all levels of Government, senior, middle and local government and sew them together with the grass roots, and we have been doing that ever since.

*David Hamilton:* My question relates to, do you consider that you are subsidising agriculture in order to achieve beneficial effects on the environment versus perhaps attempting taxation or some other missive, in order to try and achieve those environmental benefits? I guess the reason I ask this is because I speak to a number of students and colleagues overseas and generally we pay as much for food now in New Zealand as perhaps any other country in the world and interestingly, we're probably less subsidised in terms of agriculture than any other country in the world also. So I mean that is just a general observation. But it relates back to Morgan's question, why we do pay a lot for our food and yet at the same time we can look to other countries – Australia for example where they have tried to implement water reforms, but it is largely subsidised in respect of water. United States which attempts to protect its beef industry in particular. And also just going back to the original question perhaps, when do you consider you are actually subsidising, like these environmental benefits in Canada versus continuing the trend of actually paying lower consumer than what is realistic in terms of the environment.

*Marion Robinson:* I do not have the numbers but I know that Canada does not have the same subsidies as the United States. I understand the United States has a one-third subsidy on agriculture and as a consumer I can tell, because we live next door to the United States and are experiencing American dumping into our market, particularly in vegetable and fruit crops which impacts on our farmers that are not subsidised in those commodities. When we work with farm groups and commodity groups, we come away wanting them to do something like engage in environmental farm planning or expand the manure storage. They are a very conservative lot and are not about to want to do any changes. At the same time they will tell you "we will change as fast as the market changes. You want us to do something, you put up the money, and we'll do it". So where does that money come from and how does that look? It is being done so that the only environmental subsidy that I can speak of directly is the incentive programme that is linked to environmental farm planning. The farmer benefits because by taking the planning tool, not only does he improve his farm and the asset and the production, but it is a self audit where he then prioritises that which he is going to do next and therefore, the incentive is wisely put on that which needs the most environmental care first.

*Marie Murray-Benge – Western Bay of Plenty Council:* I thought that your speech was just superb and I think you might have actually answered the question just previously. What I wanted to go on to is conservation, production and how you produce the incentives to go to land use change management practices. And by the way, if you are living in central Otago you can eat beautifully, but if you buy apricots in the shops here it is like pig tucker as most of it goes to export.

*Marion Robinson:* We also export our green peppers and other greenhouse production in the Fraser Valley. 80% of our peppers are sold out of the country, but then that brings cash back into the country and around we go. Agricultural economics is very complex and in the end we do benefit because it is a primary resource. In British Columbia our primary resources are agriculture, forestry, logging and mining, with declining fisheries. If we did not have those primary resources somehow I do not think we could afford the laptops. It is our economy. I have been to other parts of the world that do not have a resource economy, they have a labour economy or they have more of a human economy and they face a slightly different future than we do with our resources.

# Reducing the Cost of Land Use Change

Rick Vallance

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## TRANSCRIPT

Tena koutou. I will start with a Maori greeting. I work for a Maori organisation, but also a great deal of the land around here is owned by iwi and in my view they are very much part of the conversation. I am delighted to be here.

The subject and title of this paper was provided to me by Ian McLean, the previous chairman of LWQS, and it followed on from regular discussions regarding the impact of land use on the lakes and how we might be able to fix that bit of the equation. My view was, and is, that there are solutions if we are all prepared to be innovative and acknowledging of the interests of landowners. What was refreshing for me was that Ian was prepared to listen, analyze, and to agree that there are likely some very interesting possibilities out in front of us.

The other refreshing thing about Ian was that he was prepared to accept that there still is a huge gap between perception and fact when it comes to land use impact. The science is rapidly catching up, but there are still remaining key gaps in knowledge. I enjoyed Ian for his open mind as well as for his energy and commitment and was happy to agree to contribute to this symposium.

### 1. A SOCIO-ECONO-ENVIRO COMPLEX PROBLEM

This lakes water quality issue is a “Social-Economic-Environmental” complex mix and unless it is addressed in a comprehensive fashion that embraces the three aspects, we will not achieve an optimal solution or even a positive one.

By positive, I mean fixing the lakes but also increasing the wealth and well-being of the community at the same time, rather than reducing it. The social well being of this community on into the future seems to me to be the ultimate measure of a successful lakes outcome. That implies very significant growth in average or per capita wealth and income which is currently at the bottom end of the New Zealand scale which throws up all the attendant social and community problems. We can not say we have successfully addressed the health of the lakes if we do so at the expense of the health, wealth and well-being of the community.

So any solution to the lakes quality has, at the same time, to contribute to a vastly increased GDP per capita. I believe we should be going at double the current appallingly low level. I read in the paper the Todd family alone have done better than Rotorua. Its time we faced up to that poor performance and the associated problems, and I believe the addressing of this lakes issue in a wealth creating way is part of the answer.

There are then the three issues to address together:

- We have an economic reality to address.
- This leads to achieving the social goals.
- To do both of those, we need to restore the environment of the lakes, for clearly if we destroy these in the pursuit of growth, we likely will not succeed.

This comprehensive approach will lead, I believe, to a likely much more successful outcome for the environment, the lakes, the economy and so the community. If on the other hand, we go into our silos and only operate on bits of the system at the expense of other bits, then in my opinion that disjointed approach simply will not succeed. What is even better, to answer Ian's question, the comprehensive approach can be largely self-funding in the long term if we go about it the right way.

## 2. PRINCIPLE BASED – SCIENCE BASED – FACTS BASED LAND USE POLICY

The next thing that matters in my view is committing to facts instead of emotion and prejudice. It is the first issue that we need to be clear about: The science and the facts. We need to ensure we are making decisions based on sound principles and not on prejudice, emotion, bigotry or envy.

There remain large gaps in the knowledge of how land use has impacted in the past and will impact in the future. For instance, the research is certainly showing unacceptable levels of nitrogen in stream waters, but it is also showing that water is older than when serious farming began with the forest removal in the 1950s. Clearly there are issues we do not fully understand. So before we panic headlong into forced change based on emotion, best we complete the science and gain the knowledge to make the right changes from both a scientific and an economic perspective; otherwise we will not help reach our social goal - the well-being of the community.

A great deal of research is currently going on, much of it on Ngati Whakaue Land with significant help from the government's Sustainable Farming Fund using AgResearch as the science provider. Te Arawa Federation of Maori Authorities and Federated Farmers have joined Ngati Whakaue Tribal Lands Inc (NWTL), with administrative assistance from New Zealand Landcare Trust, in this effort to research sustainable farming. This will link to the water research Professor Hamilton and NIWA are doing. Out of this, we are likely to get sound answers that will produce much better results than prejudiced knee jerks every time an aeroplane takes off.

## 3. PROPERTY RIGHTS CRITICAL TO FUNDING LAND USE CHANGE

In my opinion, no solution will ultimately be successful let alone affordable unless it is respectful and supportive of property rights. Abuse this at our peril.

It will not be successful because ignorant abuse of property rights will simply lead to antagonism and lack of co-operation, which in turn will lead to resorting to coercive regulation in a vain attempt to achieve change. I have been interested in so many of the themes that have been addressed by the last two speakers. Instead of major positive change,

that approach will likely achieve nothing more than intermittent and minimal compliance and guarantee failure, if not of the environmental goal (which I believe would fail or be terribly hindered), certainly the socio-economic goals.

Secondly and just as importantly, I strongly believe strategies that respect property rights and encourage innovative, profitable alternatives will end up self-funding, wealth creating for the community and guarantee success in all three areas: social, economic and environment.

We are funny people, us Kiwis. We are very concerned that personal property rights should absolutely be respected, being totally safe in your home, and always want more police to ensure they are. But when it comes to land and wealth creating activity on the land, we are sometimes quite happy to attempt to steal someone else's property potential quite arbitrarily unrelated to sound environmental issues, by acting collectively through local or central government using regulation and law, or by political manipulation of the RMA process for personal agendas. Such activities often have little to do with the environment and nothing to do with the economic objectives of the legislation. In my view, such efforts amount to nothing more than legalised theft of property and wealth creation ability and directly frustrate the three goals we need to pursue for the health of the lakes and the well-being of the community.

I see these two issues exactly the same – personal property and property rights for the landowners - and we need to respect them equally. Not only does this ambivalence and selectivity about property rights and environmentally sound land use alternatives cause much anguish and grief, it destroys much actual and potential wealth and well-being.

We should also remember that maori land owners have had far more than their fair share of such problems over the recent history of this country, and that they control a great deal of the land in question. So if we are serious about reducing the cost of change, then we need to be equally serious about respecting property rights along with sound environmental strategies.

Not only is success compromised without it, but far worse, positive investment in wealth creating land use change is shut out as we get locked into prescriptive uses determined by the limited knowledge of planners. The three goals: Social, economic and environmental, will go begging and we will all be the poorer for it. I was interested in Dr Pam Kaval's comments and I am trying to think of new ways to create a value through land use change. If we are innovative, we will, and if we are too prescriptive and too locking up, we will not. The history of planned economies is testimony.

I am certain that respect for property rights and encouragement for private land owners to search for and use their land in new, profitable and sustainable ways, creating new and greater wealth, is in fact the key to funding the whole solution to land use change in the Rotorua Lakes District. Not only will it fund land use change, but increased wealth assists the whole district fund lakes clean up. We throw that option away at our peril.

#### 4. INNOVATIVE SOLUTIONS FOR LAND USE CHANGE

Given it is a three legged problem – social, economic and environment, and that principle-based decisions are necessary to succeed, I believe the next thing to appreciate is that innovation will inevitably lead to solutions that will turn out to be wondrous and varied and not even thought of yet.

##### Management & System Changes:

The science may well throw up profitable solutions that simply require system changes rather than use changes. The research is currently showing that 80% of the damage occurs in winter: May through to September. Biological research is beginning to get a handle on reducing N output of cows by nearly as much. Add in some grazing system alternative, low and behold we may well be able to profitably remove 80% of the problem. We have more work to do but we are not far away from that sort of size of change.

Now it would be pretty silly to legislate for the removal of an industry that contributes so significantly to the social-economic goals unnecessarily wouldn't it? My point is, if we start prescribing solutions that are not sound in principle, we will not succeed on all of the three fronts.

##### Land use Change

However, let's assume that land use change is required and that management or system change is not going to work. I suspect that is in fact where we will end up. In this situation, I believe the greatest danger we face is that we will fall into the trap of authorities attempting to prescribe the changes, probably driven as much by politics and emotion as anything else. But regardless, it would almost certainly be disastrous in terms of the social and economic goals, hence my concern about abusing the RMA process. We need a paradigm shift away from the planning of particular solutions towards prescribing required effects and parameters – then encouraging innovation to achieve it. The solutions probably have not even been thought of yet!

If you do not agree, just think about the lack of success of every attempt at centralized planning for economies in New Zealand in the 70s and 80s and around the world last century; in every case the strategy fails for a very simple reason. The planners cannot possibly get it right because they can only plan based on what they know, and no group of planners know what might be or can be. We only have to think of the great false statements of the past to remind ourselves of the reality surrounding their strategy.

- Ted Watson, CEO of IBM, said in the early 1950's:  
“There will only be the need for one or two computers per country”

The computer has now become probably the greatest productivity producer in the world and there are certainly more than one in each country. So my point about planning is that it is how you see it, whether it is to be prescriptive and tightly managed or planned to be enabling. I was interested to hear Pam Kaval talk about trying to develop those non-market areas.

I believe the challenge in front of us is not to fall into the trap of trying to prescribe particular change, but rather to set out to be enabling and supportive of change. That will mean political and community leadership actively supporting new strategies for land use that certainly meet the effects based requirements of the RMA, but face down the emotional and envious prejudice that tries to prescribe particular outcomes.

## 5. POSITIVE ENABLING PLANNING ENVIRONMENT SUPPORTING OF CHANGE

I believe we have to take a new approach. We need a change to positive, enabling district and regional planning and the local political environment that will promote innovative thinking and lead to changes we have not even thought of yet; changes that will not only achieve the environmental goals, but also the social and economic goals of doubling the wealth and well-being of the community. Given a chance, these innovations will be self-funding, encouraged by enabling district and regional plans promoting environmentally sound and sustainable wealth creation.

I will give you a few example of what I mean:

### Prescriptive Plans versus Innovative Enabling Plans

A prescriptive approach to system change might be to force by regulation all farms to have a feed pad that was uneconomic to build and operate but did the environmental job of an 80% reduction, then pay for it with tax and rates. The result of this strategy of subsidising uneconomic solutions is bad economics and thereby prejudices the social goals and is unnecessary for fixing the lakes.

- Undue rating and taxation reduces social well-being, not increases it.
- It locks people into a forced “planned” system determined by the subsidies instead of searching for increased wealth from innovative solutions.
- There are better self-funding options out there.

John Green was talking to me at smoko time, and people may or may not remember, the Government tried to increase the wealth of this nation by paying farmers to have more sheep, dumped it on the market, the market prices collapsed, half the sheep had to be dumped in the ocean and New Zealand did not make any more wealth. But we certainly created a whole lot of effective waste of national effort. Subsidies can be very dangerous. I think there are better options out there.

An innovative approach might be like the following, something Ngati Whakaue Tribal Lands is currently researching and planning with the help of Scion. We have been doing some very multi-layered planning on the properties to achieve all our three goals. We are confident this process will lead to a whole series of innovative land use change that will:

- Solve the environmental goal
- Solve the economic goal by generating much more wealth than our current farming program.
- Thereby contribute to solving Rotorua’s social problems arising from a low average GCP per capita, people not reaching their potential and feeling disaffected and so on.

We kiwis are pretty good at opposing change just because of a fear or dislike of change – we are going to have to move on from that traditional reactionary strategy if these lakes are to be fixed up in a way that also benefits the community socially and economically, in my view.

For such positive, self-funding alternatives to work we need:

- Political, community and business/farming leadership that supports it
- District and regional plans that allow and encourage it

e.g. NWTL is looking at this whole issue with as open a mind as possible. Where we saw a deer farm, we now see an eco-park that restores the natural environment, fixes the lakes and creates new capital for investment in new projects that grow the economy and improve the wealth and well-being of the community.

Where we see a sheep farm, we see reduced sheep and cattle, increased native forest, some innovative new products, some high value residential sites that once again solves the social-economic-environmental equation in a positive fashion.

Where we see a dairy farm, we (don't) see a new drainage system under the ground completely removing the nutrient foot print problem, removing the N fertilizer requirement, and increasing the profitability of the farm. Maybe new crops or products will come along that leave farming for dead.

Anyone who does not believe this is possible needs to ponder the changes that have taken place in land use already, over time – they have been prodigious, and they have fed this nation. If we are sensible, we will continue to support such progress, and allow this strategy to fund both management and system changes and also, as new more profitable uses emerge, land use change.

## SUMMARY

1. **IT IS A SOCIAL-ECONOMIC-ENVIRONMENTAL COMPLEX PROBLEM** that needs a comprehensive strategy to fix it. The solutions will not be successful if the environmental goal is achieved at the expense of the social-economic requirement
2. **THE STRATEGY NEEDS TO BE A PRINCIPLE-BASED – SCIENCE-BASED – FACTS- BASED LAND USE POLICY .**
3. **PROPERTY RIGHTS ARE CRITICAL TO FUNDING LAND USE CHANGE.** The best solutions will respect, support and benefit from respecting property rights and encouraging environmentally sound, wealth creating land use alternatives.
4. **INNOVATIVE SOLUTIONS FOR LAND USE CHANGE NEED SUPPORTING.** There are a whole range of potential options. We need a paradigm shift from the tradition of centrally planned prescription to the enablement and leading of innovative change.



5. **POSITIVE ENABLING PLANNING ENVIRONMENT SUPPORTING OF CHANGE.** The District and Regional Plans need to promote and enable innovation. This is the key. Political and community leadership requirement embracing and supporting change, science chasing innovation, people thinking outside the square, and a whole new stimulating environment developing – a paradigm shift.

So rather than focus on cost, we should focus on wealth creating solutions and the creating of a regulatory, political and social environment that encourages it. The increased wealth will take care of the cost. If the Todd family in Wellington can do it, Rotorua can.

I believe we should be focussing on how we can support and enable that to happen, how we can be encouraging people to get on with it. The answers are there for the taking.

The Rotorua Lakes & Land Trust was formed by Te Arawa Federation of Maori Authorities, Federated Farmers and Lakes Water Quality Society to promote a more collaborative effort from all parties concerned that would achieve: “pure lakes, profitable farms and a prosperous community”. I firmly believe a collaborative approach between agencies, landowners, lake dwellers and the community in general, that is focussed on enhancing social, economic and environmental outcomes all at the same time for everyone will do way better than a coercive approach relying on regulation, planning and excessive control.

I was just so interested in Marion Robinson’s points, this all seems to tie in with what Canada has arrived at, that if you do not engage everyone; the regulatory authorities do not have a chance.

## QUESTIONS

*John la Roche – LWQS:* Rick, congratulations on an excellent paper and I like the idea of innovation. In order to encourage innovation - the polluter pays principle – it seems to me that if you are going to be innovative and reduce the pollution in the lakes, why not reward those people with some sort of reduction. If all the polluters had to pay their fair share of the cost and when you reduce it, you get a benefit. What do you think about that idea?

*Rick Vallance:* I think probably in the end that is where we will end up. The most important thing is to get the ball rolling and if you came in with that sort of market model on day one, I suspect you would get it wrong in design and you would shoot yourself in the foot. So the first thing to do is get the septic tanks around the lake sorted as fast as possible and get the farmers addressing the issues as fast as possible, and then probably over time a market model will evolve.

So I would not go for that first because you would get it wrong for all sorts of reasons. This is very much a leadership exercise then people embrace what they see works. Ngati Whakaue can see value in what we are doing; changing one very intensive sheep farm, which according to Environment Bay of Plenty is putting about 3 tonnes of nitrogen in three of the lakes. We are going to change that and that made me think what else can we do? I then started to think in a different way altogether and we dreamt up a scheme that will add enormous value to Ngati Whakaue and to the Rotorua economy and save the lakes. It is actually more about

discussion, enablement, leadership, positive conversations, and above all encouraging people to think outside the square. I think we will get there in the end though.

*Bryan Riesterer, Environment Bay of Plenty:* Congratulations on your discussion. What I would actually like to do is employ you for the Regional Council to sell your rating system to the people of Rotorua so that we can actually charge different people different amounts for different pollution. I am not quite sure how we can do that but I am sure that you will work out an innovative idea.

I just wanted to make a comment. I think that your view of it being a social-economic and environment issue is so important that we have got to recognise that all of those three outcomes have to be achieved before we do anything really. We can not make one work and the other two fall over. We have to address all three and I think that was the best message of your session today that we really need to think of all three. If we do not address it, we will not get there. So thank you.

*Paul Dell, Environment Bay of Plenty:* I would like to compliment you again, I think it shows that is the overall approach we are taking and it answers one of the questions earlier as to why we have not necessarily put a lot of financial money into land use change. What we are trying to do through this programme is create an environment which will drive land use change and we certainly do not want to be prescriptive. We want to be empowering of people, and we are very much on the same wavelength. I think also it is helpful when you look at economic farm surplus from different land uses like forestry, \$160 a hectare, dairy farming \$2,800 a hectare. That is one of the realities that we have got to look at in this whole programme and very early on we looked at exotic trees with stock production as a mix, but it has not been seen as a sole solution. That cuts across that economic driver and we have to have regard to that. So again, I think there are some realities when we start sitting down and looking at the numbers.

*Rick Vallance:* With this farm that we are taking out of intensive farming, we could have put it in pine trees at a huge opportunity cost of economic farm surplus, without question. I suppose the community could have paid us to do it. Instead of that, by replanting half the property in native trees and doing all the nice things like wetlands and goodness knows what; we have created an eco-park which has enormous value. Now it does seem to me that you do not need to be Einstein to work out which is the best thing to do.

*Guna Magesan Ensis:* Thanks for your confidence on our dream project and we have a student who is working on it at the moment and very soon, with your help, we will set up the demonstration sight which will be useful for other people to look at. Thank you very much, just your comment.

*Rick Vallance:* What that is, is effectively tile draining, quite close tile draining just down under the surface, certainly under the bad paddocks but who knows, maybe under the whole farm, at a cost of about, say \$1,000, a hectare. It would cost Ngati Whakaue \$200,000 to do it and that effectively operates like a lavatory. It might solve the problem. So it would be damn silly to shut down a brilliant little dairy farm if that is all we have to do. A lot of farmers do it around the world anyway, tile drain for land flooding reasons. Anyway we are going to trial it and see.

*Brian Bell – Nimmo Bell:* Thank you for a very challenging talk, I think it shows what can be done in terms of innovation. But the question I want to ask is about property rights. You stressed the great importance of property rights, I do not think you mean farmers have a property right to pollute; society has given them a licence to do that over time. So could you explain what you think farmers hold dear in terms of their property rights please?

*Rick Vallance:* Absolutely, I agree 100% and I think if we had done all the science we are now doing fifty or eighty years ago, we would be much further ahead. Farmers quite clearly do not have a licence to pollute the lakes, neither does anyone else, including all the septic tanks around the lake. None of us do. We accepted that right from the word go when this exercise got rolling and we made it our step number 1. We except that we have no right to damage the lakes.

Step number 2 is all about the science and finding solutions, but also it is this issue of property rights. What farmers hold dear is that it is an economic right, it has a value. I create value for my family and in this case for many families. For someone to legislate that away - I can not really see the difference between the fellow who breaks into your house and takes your TV set. If it is done for no good reason and without compensation. So it is the right you enjoy to use your land resource economically to produce wealth, and by wealth I am using it in a very broad sense.

Over two hundred years ago wealth was food, shelter and clothing. In our more complex societies we now do the farming over there and we live in the city, but it is not much different. It is an economic resource. My point is if the solutions that we look for are arbitrary removers of that wealth from people, you will have antagonism and all the problems associated with that. Secondly you will destroy wealth, and thirdly you probably will not do the job because someone will sabotage it.

I agree with you Bryan and all I am saying is it there is the right to enjoy your economic resource. In the end that is what really matters.

*Elizabeth Miller, LWQS:* I would like to drop a little extra thought into the conversation here. I was at another conference last week and I heard talk about a far removed community group which had been working on some of the same kind of issues that this group is working on. The philosophy that came out of that seemed to be very good to me. Their philosophy was “everybody give a little, everybody gain a little” in all the groups. Each one agreed that they would perhaps lose a little of their traditional rights, or some of the fishing areas in this case, which they might have had access to. In so doing, each person lost a little, but in the whole community, each person gained a little because they had other benefits from not polluting or not over-using those resources. I just wanted to drop that thought in.

*Rick Vallance:* Thank you Elizabeth, I do not disagree with you. Often we get tangled up in words unfortunately. These non-market values are terribly important; my point is if you think hard enough you can find ways to value them. Stop and say they are valuable, but we have got to go one step further to solve some of the problems you were talking about.

## **The Australian Case Studies in Lakes, Waterways, Clean Up and the Burden of Cost**

Rod McInnes

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### **TRANSCRIPT**

My purpose this morning is to give you an overview of where Australia is in dealing with the problems that are similar to your own in terms of the diffuse pollution of lakes and waterways. I will start by going through some of the concepts, refreshing your memories from Pam's talk yesterday and take you through an overview of how cost and cost-sharing is dealt with in Australia. I will then take you through three case studies; one case study in some detail which has an algal problem similar to your own, though you will note that none of these are dealing with lakes *per se*.

Australia has a dearth of fresh water lakes and some of those that we have are ephemeral anyway, they dry up. We certainly, as you would be aware, have some problems with our saline coastal lakes through development impacts, but unfortunately we have not advanced I think far enough with any of those to give you a good case study. So what I am using are case studies which are analogous to what the real problems that you have here in terms of organisation, and I will try and draw out the particular points which I think are relevant; and finally I will give you some key points in summary.

I am from the Sydney Catchment Authority. I have also been working in water resource management throughout Australia, in Western Australia, Queensland in a consulting role and I have a fair understanding of point source, diffuse source pollution problems as you have here in the lakes, because I have worked on many projects. I will try and draw out the points through the talk where I think the Australian and New Zealand situations are analogous, even though we are talking about our very different ecosystems.

### **Burden of Cost Principles**

Characteristics of costs of lake and waterway restoration

For lake and waterway restoration typically:

- *may be incentives to pollute (eg. subsidies, unclear property rights)*
- *hard to exclude new polluters (eg. homeowners)*
- *may be incentives for parties to not act (free riders)*
- *actions are uncertain, so input costs difficult to know.*
- *involve many parties, so that transaction costs are high*
- *outcomes are uncertain, so value of output unclear*

- **Implication:** Lake pollution has aspects of common property resources that need common action

If we consider, and this is perhaps more of a global view that we got yesterday from Robert Costanza, that throughout the world lake and water restoration typically has major problems because there may be incentives to pollute, there may be, as in Europe and the US, actual subsidies which encourage people to put nitrogen nutrients into their waterways.

But even where there are no subsidies, like in Australia and New Zealand, there may be problems because of unfair property rights. There is no clear rule that says “no you’re not allowed to put that nitrogen into that ground water” or “you’re not allowed to fertilise that particular area”. Some people may think they have a right, other people may think they do not have a right to deal with nutrients in a certain way and that lack of clarity leads to the many problems that we have with lake and waterway quality from nutrient pollution. Often the rules are such that it is hard to exclude polluters.

In Australia we have a problem with development and certainly in our own city, Sydney, we have problems with new development where the development rules do not actually stop home owners polluting waterways. There are plenty of rules about road and water access, but no rules to do with the nutrient problems that those developments create.

Of course once you realise there is a problem and you go about fixing it, there could well still be a problem because people will say – “well, the ratepayers, the other people in the community, will pay for this problem. If I sit back and do nothing, I will get that all cleaned up and there will be no problem”. Of course if you have a few too many of those kinds of people, and that is human nature, then the people who are actually bearing the load and paying the cost say, “well you know I don’t think it’s worthwhile doing anything because that guy’s not going to bring his share”. So in economics we talk about the free rider problem; it is not some abstract theory, it is something that communities like you and us in Australia deal with all the time, about getting people on board so that everybody contributes.

If you could solve all of those problems, you would still be left with the great uncertainty that we have with a lot of the environmental problems we are dealing with. As I go through the case studies you might work out an action that you think will solve the problem, but the uncertainty is so great that there might be a 50% chance that this action will not work. How do you make a decision when you have such uncertainty?

We have talked about free riders, another example of that is simply that if you have many people involved, ten or fifty thousand people in a city, who have different interests; it is often hard to bring those people together. Economists talk about transaction costs but that simply means that it is very hard to get people together to agree and co-ordinate funding and other things when you have many parties.

I have talked about the actions as being uncertain, but the other side to that is often the outcomes are uncertain and therefore, valuing those outputs – Pam gave you a very good rundown yesterday on how you might value through contingent valuation or other valuation techniques that might value the outcomes of a cleaner lake. But the uncertainty is such that you have to present people options and say “we might have a 50% chance of cleaning up the

lake and 50% not”. It is very hard to give people a choice and get them to value that outcome when there is such uncertainty.

The economic conclusion with all of this is that lake pollution has aspects of common property that need common action.

### **Diffuse Pollution “Commons”**

- Open access resources - Examples
  - *fisheries*
  - *groundwater*
  - *greenhouse gas*
  - *whaling, and*
  - *pollution of lakes and waterways*
  - *Consequence: need to focus on institutional costs, not just nutrient treatment, as these are likely to be high, and specific to the water quality problem.*

This basically comes straight out of the key points that Robert Costanza was making yesterday. Throughout our use of resources in the world – fisheries, groundwater, greenhouse gas, whaling and pollution of lakes and waterways – there is a lack of action because we treat these resources as common property. We do not treat them for all of the issues I mentioned above in Costs. We do not actually treat them as things that we can protect and want to act upon. So in terms of the following presentation, I am going to focus not just on the cost of cleaning up, that is the cost of removing the nutrient or whatever from the waterway, but also on institutional costs, the cost of organising people to deal with the common problem and to deal with all of those institutional issues of free riders and so on that I mentioned.

### **Key Cost Issues**

- What costs?
  - *Efficient nutrient control input costs*
  - *Includes institutional costs, such as private effort*
- Whose share?
  - *Polluter pays*
  - *Beneficiary (User) pays*
  - *Government?*
- Cost shares that induce the most efficient investment?

What are the key issues? The key thing is that we address the nutrient problem here in Rotorua or in the case studies that I mentioned in Australia, in an efficient manner. For an economist (again this is a point that Professor Costanza made) probably the first threshold issue is that we address things efficiently; we do not spend more, or do more, than we need to do to solve the problem. My other key point is that we need not to just include the treatment of the nutrient problem, but also the private actions, the private effort of people, the organisation costs that also address the pollution.

But in Australia we have also focused on the method that is used for allocating costs, once you have decided what the efficient cost to address your nutrient problem might be. Now it might be a sewerage treatment plant, let's say that is going to solve the entire problem and it is going to cost you \$50 million. Then there is the question of how you allocate those costs. The normal approach is to say that the polluter should pay. All of the cost guidelines in Australia say the threshold issue is that polluter should pay. In many cases, of course though, in Australia the polluter does not pay and the critical issue is being able to identify the polluter where there is uncertainty, being able to have a funding mechanism that accesses that person. It is all very well to say that a particular person is liable, but if you have no legal instrument to charge that person, then they are not going to pay.

So if you like, the alternative for a polluter of nutrient to pay is the beneficiary. If the lake is cleaned up and other people enjoy that improved lake, they could pay. This is a model that is used in lots of other things; the user pays model – if you are using the environment, you should pay. However, in the diffuse pollution issues the Australian rule is generally that the polluter should pay and then if there is not a clear mechanism to get the polluter to pay, then the beneficiary could pay.

There is sometimes in Australian guidelines a third group, Government. I would argue that Government is not a third group at all; the Government is no more than you or I as an Australian taxpayer or a New Zealand taxpayer, you are paying money which will, if it goes on say, a lake clean up or a waterway clean up, eventually come out of your pocket. So if the Government pays, they will get taxpayers somewhere to pay for that. If you establish a precedent that this type of activity should occur, then other people throughout the country will also have a call on that type of funding; and eventually you will pay, you will pay for works elsewhere as well as your works locally through your taxes.

In terms of beneficiary or user pays, it is critical in Government funding that we are clear that there is beneficiary or user paying. Government has a clear role in being able to fund over time. It may be able to allow users of an environment to pay over many years, and through the tax system collect that money back, and maybe allow a cost to be shared across the country; so if there are significant benefits, for example in the Rotorua area, but other spill overs to the rest of the country, they may be able to pick those up. But, and the key point here, Government is not some – the Australian term is “magic pudding” – the Government is not a “magic pudding”; there is not some invisible fund there. Government is only, and can only, be efficiently a representative of beneficiaries or users of the environment.

The final point is that any cost shares must be those cost shares that induce the most efficient investment. We do not want to be spending too much on what we are doing.

### **Survey of Australian Issues**

I have gone through a whole range of case studies (*Figures 1 and 2.*). You may have heard about the problems in the Swan-Canning catchment in Western Australia. I believe some of you are representing some of the solutions to their lake, the phosphorus locking technology that they use. In Melbourne there have been major works to remove nitrogen from Port Philip Bay, mainly done through Melbourne Water through a point source methodology. I am not going to go through these in detail just look at a few samples (*Figure 3.*).

Figure 1.

Survey of Australian Issues				
Issue	Location	Treatment	Burden of Cost	Outcome
Diffuse and quasi-point* source nutrient pollution of large bay, with slow flushing	Port Phillip Bay, Melbourne Victoria	Sewage and stormwater engineering treatments to remove 10000 tonnes per annum of Nitrogen equally shared between each.	Unknown. Cost recovery is via drainage rate (property value based) and sewage charge (nominal usage based). Incidence of charges is likely to be identical, so cost share per se, is probably irrelevant.	Still to be completed. Expected outcome is reduction in risk of fish kills, visual etc pollution from algae.
Diffuse to estuary/lagoon	Brisbane River/ Great Barrier Reef	Diverse range of actions across catchment, point and diffuse	Explicit accounting procedures established, but not applied.	Reduction in a wide range of pollutants.
Diffuse to freshwater and estuary	Swan River	Phosphorous locking technology in rural areas, stormwater ponding in urban areas.	Ponding paid for by developers through headworks charges.	Reduction or at least maintenance of existing rates of algal pollution

Figure 2.

Continued				
Issue	Location	Treatment	Burden of Cost	Outcome
Diffuse saline pollution from irrigation induced recharge of surface (water table) aquifers.	Lower Murray Region of NSW (Berriquin)	Soil drainage, sacrifice areas, reuse and recycling using spearpoint wells. Other efficiency measures.	Agreed upfront cost shares for long term program. Project/ resource management from State charged partly through water prices.	Reduction in water tables to below the 1M level where capillary action causes salinisation.
Nutrient pollution of groundwater/risk to coral lagoon/ overextraction of groundwater	Lord Howe Island	Capped development using a tourist bed quota.	New entrants to the industry, through lost opportunities. The lack of liquidity in quotas may also put a burden on insiders wishing to expand.	Residents not included in quota, quota not clearly policed, little relation of quota to underlying problem (cf. waste quota).
Nutrient, pathogen pollution of waterways	Qld/Victoria	Suite of controls and incentives from a central catchment authority:	Planning, controls place cost burden on developers (e.g lost opportunities, compliance works etc).	Unclear – measurement problems/ political pressures.



Figure 3.

Selected Case Studies		
Type of Pollution	Case Study Location	Cost Sharing
Point and Diffuse Source Pollution of coastal lakes and estuaries	Hawkesbury-Nepean Estuary	Cost met through water utility pricing and local government rates.
Diffuse Agricultural Pollution	Murray Darling Basin	Cost met through central Government payments, in-kind contributions from farmers and utility administration contributions.
Diffuse pollution caused by historical actions	New South Wales	Costs met through pricing of water/ government.
Diffuse pollution from residential sources	Lord Howe Island and others	Costs met by landholders through compliance actions or forgone business opportunities.

Firstly, I am going to talk a bit in detail about point source, and diffuse solution in the estuary of the Hawkesbury Nepean River, where the cost sharing methodology used there is largely through the water utilities and local government Rates.

Secondly, I am going to talk about – not a nutrient problem, but a salinity problem, but it is still a diffuse pollution problem that has analogy to what you have here. This is in the Murray Darling Basin and in this case costs are met through Central Government - payments which in this case I would argue are efficient Government payments; also in-kind contributions from farmers and charges from a local water utility.

Thirdly, I am going to look at a situation in New South Wales where costs have been met through pricing of water; and the critical issue here is that it deals with an issue called legacy costs. I will explain that when we get to it, but I do know that is an issue here in Rotorua where in some cases the nutrients that you are addressing have begun their path to the lakes thirty or forty years ago.

Finally, I am going to look at the diffuse solution from residential sources, actually on Lord Howe Island, a lagoon rather than a lake, but there we are looking at a regulatory solution. I will take you through some of the consequences of a regulatory solution.

## Case Study 1: Point and Diffuse pollution in the Hawkesbury Nepean River

- **Problem:** increased frequency of red tides in estuary, and blue-green algae and weed in freshwater area of river
- **Cause:** reduced river flows from overextraction (downstream of dams); increased point (sewerage) and diffuse (stormwater, septs, agriculture) nutrient inputs across entire catchment
- **Response:**
  - Environmental flows by 2015 (or earlier if possible)
  - Improved sewerage treatment (well advanced)
  - Stormwater – modest response.
  - Septs – regulatory program, but slow rollout.
- But, some success in at least one council area

The Hawkesbury Nepean River is the major river around Sydney. Most of Sydney city is not in the Hawkesbury catchment. It is about 300km long, about 20,000 square kilometres in area, fairly sizable for a coastal catchment in Australia. It is characterised by being highly regulated; it has many dams on it because it provides the water supply for Sydney. So basically very little water gets past this area of river [*Pointing to Nepean-Wollondilly junction on a map*] where there is the major Warragamba Dam.

The lower reaches of the river therefore suffer from a number of pollution issues. There are blue-green algal problems somewhat similar to what you have here in Rotorua, in the freshwater portion of the river below the dams. In the estuary there is an increased frequency of red tides caused by phytoplankton, a very similar analogous problem to the blue-green algae in that both cases the key driver is nutrients. This is the key normally, but there are many factors involved and it is a complex ecosystem.

If we step back and look at the causes of those algal blooms, the major cause as I mentioned is the over-extraction, the damming of the rivers, the regulating of those rivers which means there are very low flows in the lower portion of the river. I understand that is not such an issue here in Rotorua, but we basically end up with a very similar problem. The actual sources of nutrients, which is the other key part of the problem, is coming from sewage, and from diffuse sources – stormwater, septic tanks, agriculture, nutrient inputs across the entire catchment. Overall, in the entire catchment about 80% of the nutrients coming into the river – nitrogen and phosphorus – are coming from agriculture.

The response to this problem across the catchment has been a fairly delayed approach to environmental flows, actually increasing the flows from the dams which flush out some of these nutrients. The environmental flows are not due to occur until 2015 and in the meantime, the focus has been on improving sewerage treatment and that is well advanced.

Many of the point source nutrients have been removed from the river. Stormwater – there has been a fairly modest response. Councils have found it a struggle to be able to put in stormwater treatment. Their revenue is regulated and in consequence, they struggle to find a funding mechanism for those works. With septic tanks there is a regulatory programme to make sure that people are maintaining their sewerage trenches, but in reality the roll-out of that programme has been very slow. Overall, the actual quality of the river continues to decline, there continues to be blue-green algal blooms, the point sources have been addressed but the diffuse sources have proved really difficult to work with.

So what I am going to do is look at one Council area where there has been some success, not just on point sources but also on non-point, and I will run through that and see if we can learn something from it.

Very close to the Hawkesbury-Nepean's outlet to the sea there is a small catchment called Berowra Creek Catchment fed by streams that are around the Hornsby area. It is a small enclosed catchment, in the red area [*Pointing to red area on map*] it has some urban development. So if you like, in analogy that is somewhat like the development on the side of the lake here at Rotorua. It has some areas of agriculture, rural land and it has in the main, quite a large area of largely pristine bushland. There is one problem, however, though that seems to dominate all others. There are two STP's that flow into this catchment and they provide a flow of fresh water to the estuary which is high in nutrient, high in nitrogen, well above the native natural flows in the catchment. So there is a problem here, what can we do about it?

### **Step 1: Efficient cost: Analysing the Cost Burden**

- *Hawkesbury Nepean Estuary*
- *Detailed biophysical modelling of algal activity under different nutrient regimes*
- *Impact on shellfish aquaculture and recreational use of the waterway*
- *Use of Contingent valuation methodology for valuing algal pollution impacts under different management regimes*
- *Evaluation of costs against benefits – efficient cost*

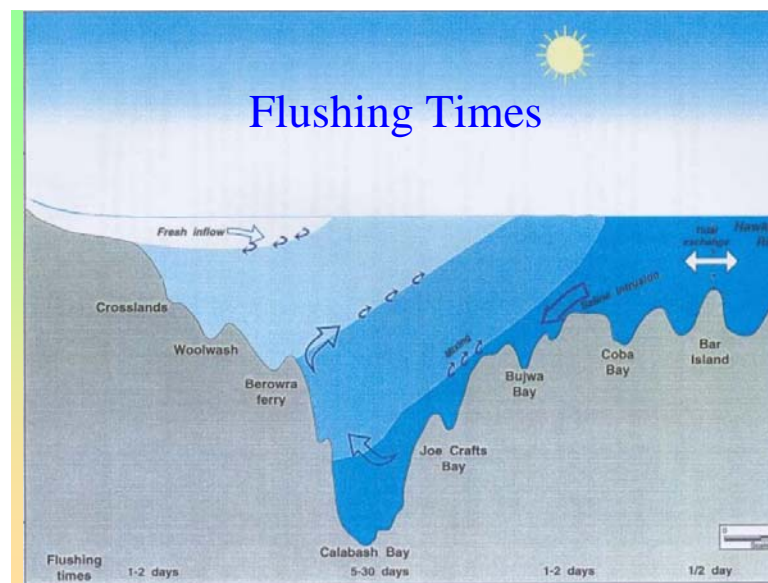
The approach that was taken on this project was to do some detailed bio-physical modelling of the algal activity and create some forecasts of the red tide frequency. There is great uncertainty of modelling, but it was undertaken with the purpose that if we did not know and could not predict what the problem was, even if only roughly, it was very hard to deal effectively with any action.

We also looked at the impact on shellfish, agriculture and recreational use of the upper waterway. This estuary area is used for oysters so there is a commercial impact there. The commercial impact though is quite minimal as it is only a small industry.

What we found and what we did as well, and as Pam explained yesterday, that where there is something that is non-commercial, non-financial, there is an impact here in terms of loss of recreation on the waterway. We needed to be able to value that in some sense and we used a method called Contingent Valuation which is basically a market research technique. So we went out, showed people what the problem was and what could be done about it and asked them to value various outcomes.

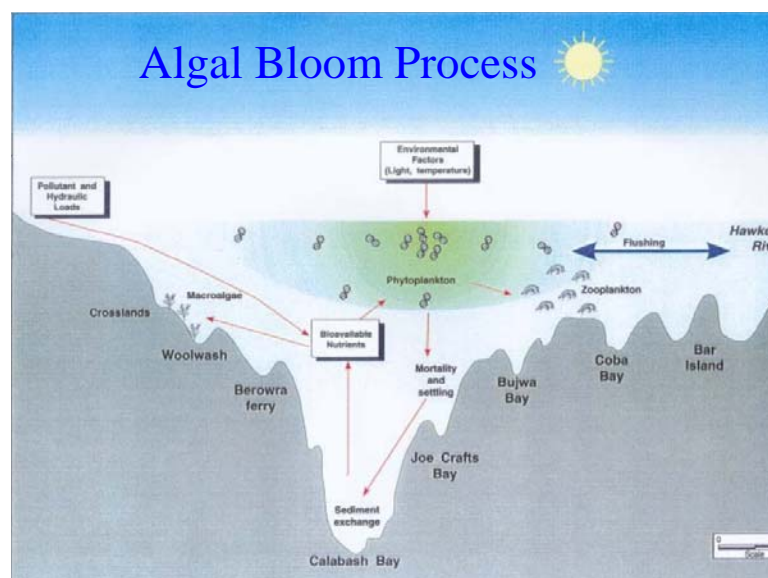
We took those values, the commercial and non-use, and put the value out of those benefits against the costs of various options. This is the area, (slide not shown) lovely and pristine but unfortunately sometimes there are red tide algal blooms which cause major problems.

### Flushing Times



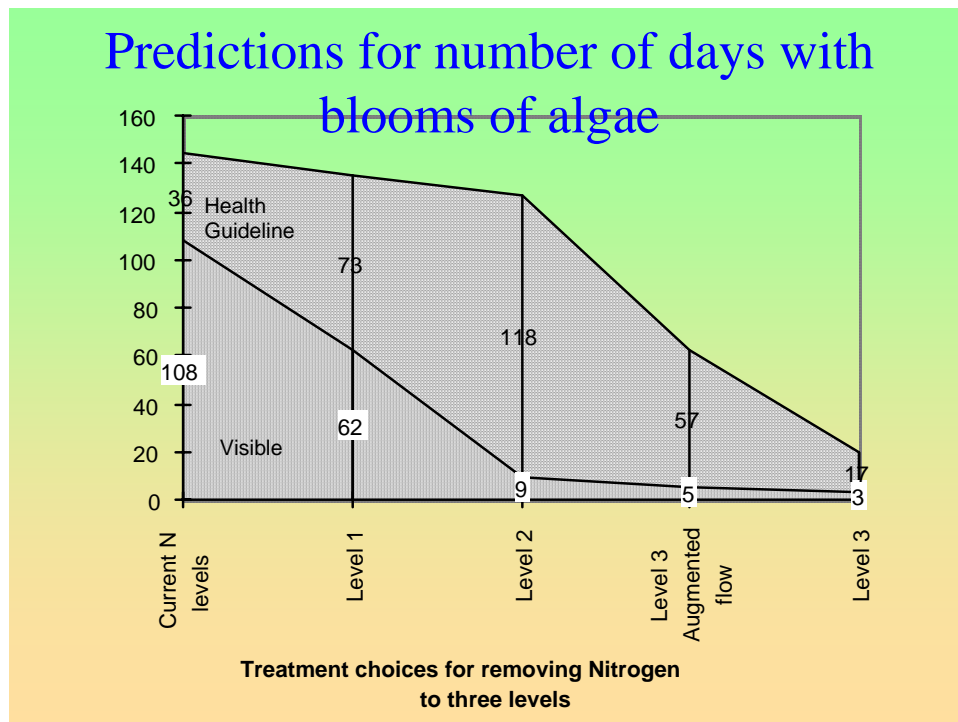
The slide above is a cross-section of the bay, you can see that there is a major deep area, and the key point here is that the flushing of that area is quite slow, 5 to 30 days; and it is in that area which does not flush very well that we then have an algal problem.

### Algal Bloom Process



We have a build up of phytoplankton which can give you a red tide situation.

## Predictions



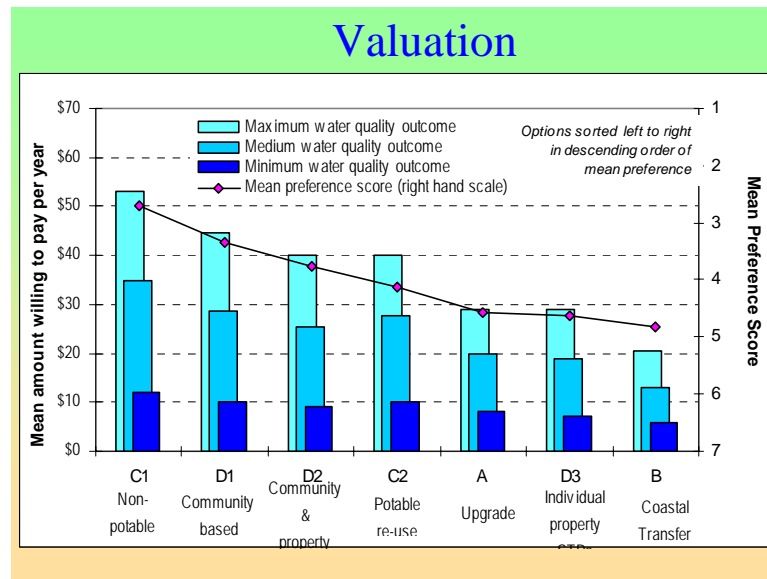
So the bio-physical modelling was done; we then presented to people the above chart and I will take you through it. Basically there is a health guideline [*Pointing to “Health Guideline” – upper portion of area chart*] where if there is a certain count above that health guideline, and then the water is regarded under the ANZECC<sup>1</sup> procedures as being unsafe. There is also another threshold [*Pointing to “Visible” – lower portion of area chart*] where there is actually visible algal pollution. So what we said to people is, [*Pointing to “Current N Levels” – y-axis*] this is your existing situation. [*Pointing to zero to 100+ range on y-axis*] 108 days out of 365 days of the year, you will see visible pollution. That does not mean this dark red tide but you will see murkiness and other problems which are associated with the build-up of phytoplankton. [*Pointing to 100+ to 140 range on y-axis*] For another 36 days of the year, the water will not appear to be polluted but it will still not meet the health guidelines so it really is probably not safe to swim in that area.

So that is the existing situation, what we can provide is a series of options, level 1, level 2, level 3 [*Pointing to options along x-axis*] – each of which provide an improvement. So we could go if you like from 108 days down to 62 days [*Pointing to upper bound of “Visible” area on chart, moving left to right*], down to 9 days – so in this situation there would be only 9 days in 365 that there would be any visible pollution.

We then presented this information to people, not just on the change in water quality, but we also gave them information on a series of options.

<sup>1</sup> Australian and New Zealand Environment and Conservation Council (ANZECC) 1992. The Guidelines were updated in 2000 See [http://contamsites.landcareresearch.co.nz/anzec\\_guidelines.htm](http://contamsites.landcareresearch.co.nz/anzec_guidelines.htm) for more details.

## Valuation



From pollution control options – and these are everything from:-

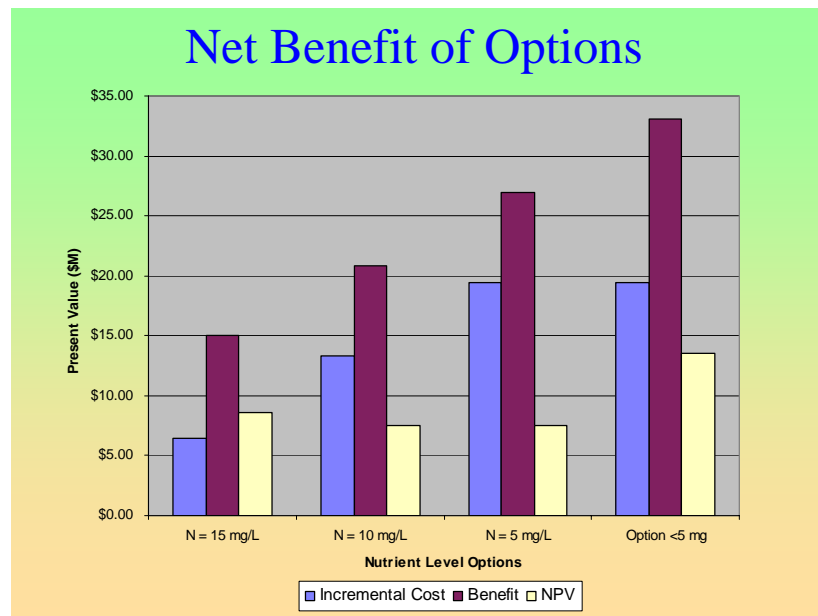
- *Transfer the sewerage out to the coast; [Pointing to Option B – far right]*
- *Deal with it on site by septic tank [Pointing to Option D3 – second last on far right] ;*
- *A non-potable reuse option [Pointing to Option C1 – far left] - treated water in your backyard.*

For each option there was a

- *minimum water quality outcome which if you like is the 108 days moving down to 62 days;*
- *medium water quality which is say, moving down to 9 days only of the year when the problem occurs;*
- *maximum water quality moving down to only 2 or 3 days per year that the water's polluted.*

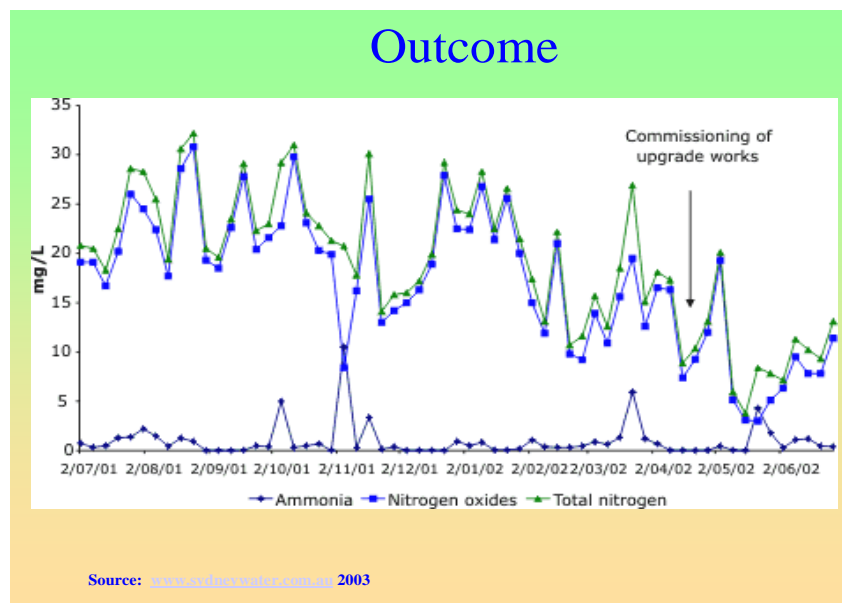
So people were willing to pay in the survey quite significant amounts. For example, \$50 for a non-potable reuse option and the maximum water quality [Pointing to Option C1 – far left, picking out “Maximum Water Quality” histogram – light blue - and tracing to left hand y-axis at \$50 mean amount willingness to pay. But generally people were not happy with the coastal transfer options and there were various other options filled in between. I mentioned the individual property option – that was quite unpopular too as you might imagine, so people did not want the sewerage treated on their own property.

## Net Benefit of Options



So from this we calculated the individual willingness to pay and turned that into a total benefit. So we have taken the population of the 50,000 or so people who lived in the region and turned it into a total benefit. This is simplified chart with not all the options, just looking at the levels of treatment. This is the 15mg/litre is the level 1 [*Pointing to left hand side set of three histograms "N=15mg/L"* ], the low level of treatment that only gives you 62 days and then the higher levels of treatment [*Pointing to other sets to right hand side*]. What we found is that if you take the highest level of treatment or the minimum days of affected water per annum, people are willing to pay a quite substantial amount above \$30 million [*Pointing to <5mg/L benefit – crimson bar – far right*] for that benefit. Put that against the incremental costs of the project and we find that there is a significant benefit and therefore we have established if you like the efficient cost for the project.

## Outcome



The project was commissioned and these are the actual results. We had the project commissioned at this stage (*pointing to the beginning*), at this particular point they got the plant down 5mg/litre (*pointing to near the right hand bottom left*). I notice in the next few months they struggled a bit but we are still keeping it well below the levels that were previously there and I understand that today these plants operate at less than 5mg/litre. So there is low nitrogen and low phosphorus and a very low frequency of algal blooms. So that is the project and the process we went through.

### **Institutional**

- *Community groups formed – community consultation and Bushcare groups.*
- *Strong local willingness to pay for environmental improvement*
- *Environmental levy introduced to address stormwater pollution - \$4-\$5 M per annum.*
- *Funding sought and gained from national etc programs*
- *In kind contribution in labour for related Bushcare works*
- *Education and marketing activities funded.*

What was actually just as important was the way it was done institutionally in the Council. There were community groups formed, consultation and this was linked in with the care of vegetation in the catchment, so there were Bushcare groups established.

The strong willingness to pay for environmental improvement, that is - the people thought from what we saw in this survey that they were getting a benefit; it was also reflected in people's own actions. They were prepared to do something in their backyard in terms of that vegetation and other management to improve water quality.

And the local politicians found that when they put to the community that there would be an environmental levy to deal with stormwater, that the awareness and acceptability of that allowed them to raise an extra 5% on their rate base, which basically became an extra \$4 to 5 million per annum to clean up the waterway, so it dealt with the stormwater and more diffuse sources.

There was funding sought from national Government and some of that was involved in the Bushcare and other programmes. But I think most importantly there was quite a substantial in-kind contribution; people work in bush care, cleaning up vegetation in the streams leading to the creek and improving the value of their homes, improving the value of their community, improving the value of their waterway; and this environmental levy also funded education and marketing activities.

So I guess the key take home message here is in this river as a whole there have been major problems dealing with the problem holistically. In a particular situation where somewhat fortuitously most of the cost related to point source, a process was gone through which established a solution to that point source problem, but also with it established a commitment to fixing the non-point problems.

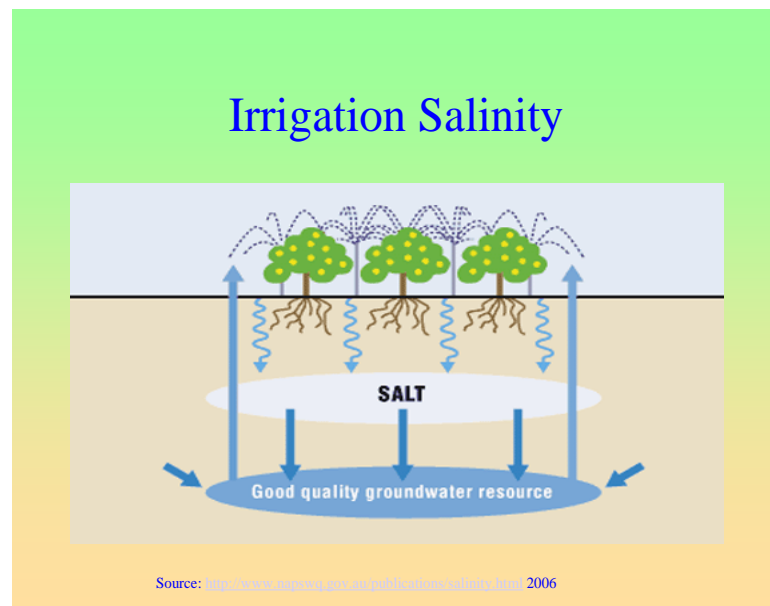


## Case Study 2: Diffuse Agricultural Pollution

- *Murray Darling Basin particularly suffers from salinity caused by excessive irrigation*
- *Measures to deal with it have had mixed success.*

Here are two or three other examples: we have a major problem in the Murray Darling Basin with salinity. Part of that problem was an irrigation salinity problem; again I was talking to actually somebody here last night who was an irrigator in the Murray Darling Basin.

### Irrigation Salinity



Much of the Murray Darling Basin has salt load [*Pointing - in the subsoil*]. The irrigation raises the water table and can rise the salt up and kill the trees that are there and so you end up with salinity damage, basically salt scalds and dead trees.

In the main, there have been major problems with dealing with that diffuse source problem. However in the Lower Murray region there has been a major study which looked at what the response was to what was done in that region and there were a few key points that came out of that.

### Response

*The Lower Murray has been more successful due to a number of factors.*

- *Leadership*
- *Cost sharing*
- *Participants share benefits as water tables stabilise*

The use of existing local organisations and leadership of those organisations enabled people to come up with solutions to the problem themselves and the other aspect of leadership is in this case central Government basically allowed those local decisions to drive what was done.

Central Government was involved in funding and facilitating and spending the cost of getting those people together, but it was prepared to accept the decisions brought together by the local people.

A cost sharing arrangement which is a combination of polluter pays and beneficiary pays was negotiated between the parties. A lot of time and effort put into negotiating something that people thought was fair and basically met that threshold test of being able to drive forward the efficient investment to fix the problem.

One key thing, which I think has to be thought about in your context, is to remember here that this is a rising water table that affects the farmers' productivity. The participants share the benefits; if they lower the water table through collective action, they share the benefits because their crops are no longer affected; something that's been harder to replicate in other situations.

### **Case Study 3: Legacy Pollution**

The third study is to do with the issue of legacy pollution. In the previous case study, that salinity may have occurred, there will be some salinity which has been driven immediately at this moment by the actions of the irrigators themselves and which they can change. However some of that salinity would be salinity that is travelling through the system, through the groundwater that may have been caused by farmers thirty or forty years ago. I know there is an analogy here in Rotorua because in some cases some of the nutrient pollution is coming from thirty or forty years back, from changes that were made under Government policy at the time for land use.

How does New South Wales, how does Australia deal with that issue? There is a funding mechanism which in the irrigators' case is paid through their water charges. However there is always a huge bun-fight between irrigators and Government as to what their charge should be. The regulator, rather than Government, determines the cost shares and in 2000 I was working for a company Acil Tasman which was asked to determine those cost shares.

#### **Rules adopted**

- *Polluter pays for current impacts*
- *Legacy costs (current impacts by past actions) separated*
- *Legacy costs to be negotiated between Government and users*
- *Proviso – if beneficiary pays adopted, legacy share of users should increase.*

Basically this is where we came down to. We used a polluter pays impact effect test for current impacts. Where a land user was creating a pollution problem at this moment, then in the main we ask that the polluter pays for those.

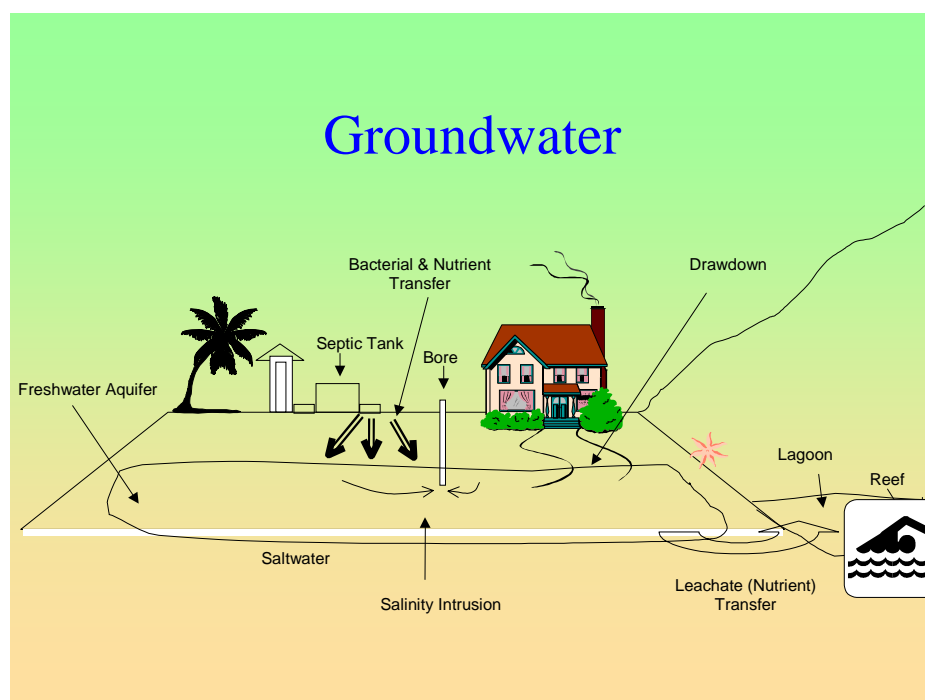
However, where impacts were from past actions, for example development – a soldier settler development of an irrigation area done under poor advice which has resulted in extra pollution - we asked that those costs be separated. Those costs have been negotiated between Government and users but in the main the suggestion is that Government, because it was responsible for previous policy, should pick up that cost.

One proviso to that, because it was only advice from the regulator, we said to the regulator that if they decided that a beneficiary pays system be adopted, that in this case the beneficiary would be seen as the Government because there is some public benefit by these actions; then they should look again at that legacy share of users. I guess we were saying that you can not have it both ways.

#### **Case Study 4: Diffuse pollution from residential sources - Lord Howe Island**

Very quickly, a mid-Tasman example. On Lord Howe Island there is a groundwater issue with basically diffuse pollution to the lagoon. Lord Howe does not in fact have this problem; it is a threat, not an existing problem.

#### **Groundwater**



So basically there is the island [Pointing to schematic of island], the house, the bores and septic tanks and so on, there is the groundwater going into the lagoon [Pointing to “Leachate (Nutrient) Transfer” arrow to right hand side]. This is a microcosm of what happens in the Barrier Reef. The Barrier Reef lagoon is probably our most important environmental issue in terms of diffuse pollution.

## **Current approach**

- *A development quota (beds)*
- *Regulation of new development*
- *Onus on developer to prove safety*
- *However, little resource information for developers to use.*
- *No modelled information on impact of development – threat not clear*

A direct approach was tried here; basically they put in a development quota that said how many people could be on the island, using beds as a proxy for the number of people. That was to restrict the septic loads to the lagoon. They regulated new development – so they said we restrict visitors, but we restrict residents by restricting how quickly they can build homes. However there is a key failing in this system. There is little resource information for developers to use to know whether the development control is working or not.

## **Building Action**

Some key summary points.

In those examples when we are looking at the diffuse problems, that are the problems of free riders and so on, there needs to be a common judgement of some impending harm. For example, in Lord Howe Island, without information it is very hard for those people to see that there is harm; whereas in Berowra Creek through modelling, the community was able to be told that there is a major problem, it is going to get worse, this is what you need to do about it.

Where the rules are applied, those rules need to be applied in similar ways and this was some of the example coming out of the Murray Darling Basin, where irrigators were involved in making the rules that applied to them, they had some buy-in and they had some benefit from it – if they were prepared to put rules up themselves.

People need to value highly the continuation of resources from the resource. The Berowra Creek people valued the recreational use of their estuary and were prepared to pay for it. We need to keep information costs low, so in the Berowra Creek case, in the Murray Darling Basin case, Government made sure that there was clear information about the problem. We invested money into making sure it was well-known.

I think these are particular lessons for Rotorua: those people needed to share trust. In many Australian examples, the breakdown of cost sharing was because the users or the polluters did not trust the Government agencies they dealt with.

We need to form a stable group, something that will stay around for a long time.

## **Criteria for Successful Action**

- Criteria for collective action:
  - *Small number of decision-makers*
  - *Small number of participants minimally necessary to achieve the collective benefit*

- *Low discount rate in use – long term view*
- *Close similarities of interests*
- *Participants with substantial leadership or other assets*

## **Conclusions**

My conclusion is that I think Australia still has a long way to go to address lake and waterway clean-up.

The burden of cost must not be just seen as the cost of mitigation works.

We must also think about the time of organisations, the actual impacts on users and polluters of the environment and to spend time in getting those parties to negotiate to come up with a solution. I think the Australian lesson has been that if you feel that you have got the point source solution fixed and that the diffuse will then follow, you are being too trusting. Our experience has been that the point source work has been fairly straightforward and though we have had plans for diffuse, many of those plans have been hard to implement and complete.

## **QUESTIONS**

*John Green – LWQS:* Thank you Rod. A couple of conclusions I have got. It seems to me that the blue-green algae comes from Australia and therefore could you come and help us pay for our costs?!

The one thing that I have drawn from your presentation which I enjoyed was that the cost that Paul Dell puts up before us, we should be breaking down into legacy. Our last sewerage has been allowed to be dumped into Lake Rotorua for thirty years. Current polluters which include residents around the lake and perhaps one other category which you perhaps do not have the experience of, but it would be the polluting effect coming from the natural environments of the volcanic activity that exists around our lakes. I like to think that the legacy costs are a Government cost; I think it is very unfair for the current generation to pay for something that was incurred by the previous generation. So would that be your view that we should be breaking our costs down into a categorisation of those who in principle should be responsible for the types of costs that we are about to incur?

*Rod McInnes:* Well I can not specify what the solution to your problem is; you need to work that out yourselves. I can certainly talk about the Australian experience. The key reasons for splitting out the legacy cost are to make sure that the incentives to solve the current problem are right. That is if we can isolate what are the current behaviours that we can control which are driving pollution and to create the right incentives to reduce that pollution, then we have got the necessary but not sufficient conditions to solving the problem. Once we have identified those current pollution sources and the costs that are needed to mitigate or fix that, and I think this is significant here in Rotorua, then there still are those pollutants which may be coming through groundwater but have been travelling for some years and which are going to be quite difficult to intercept and may be quite costly to deal with.

Our position in New South Wales was not that Government pay - our view was that it should be negotiated between the parties with a significant Government portion, but again the critical

thing was being able to create the funding and the effort to solve the problem. In Australia in the Murray Darling Basin, as I said there have been problems with dealing with diffuse pollution and I would not give that as an example of how you should go.

But there are in fact natural sources of salinity which come from sunken sea beds in the western part of the Murray Darling Basin. What the Government has done is put in bore fields which basically intercept that groundwater flowing into the river and use it as a low cost way of dealing with the legacy cost. The wider problem of irrigation induced salinity is harder to intercept because it is so diffuse. So it basically used its natural point source to reduce the mitigation cost. I have no idea whether that would be an acceptable or cost-effective option for you, but it is just something that has been done in Australia.

*Rowland Burdon – Royal Society of New Zealand:* Regarding legacy costs and legacy costs, how messy a process is it distinguishing between the two and how much acceptance do you get and what are the problems of getting acceptance of that partitioning? I can see that here we have maybe a special problem with legacy costs, given the very long residence times of groundwater.

*Rod McInnes:* I guess my overview comments would apply. In dealing with diffuse situations generally whether it is created from a legacy situation where you have got pollutants established long in the past or whether it is a current situation, there is a need for setting up institutions to try and reduce the transaction costs. That is all economic gobbledygook but the key thing is that there is a lack of clarity in allocating costs and therefore we need to establish some trust amongst the parties and negotiate in good faith to come to an allocation that will never be exactly right but is sufficiently accepted to lead to solutions that will be funded. So the legacy concept is simply a way of being able to see the problem so that you can deal with the current impacts which are probably the easiest part of a difficult problem to solve; and separate the contentious and difficult issue of how you deal with the ones in the past. Although I would say the problem is always difficult to solve, the best solution (and I think the Royal Society would support this) would be to have good biophysical information, as much as we can about the flow of groundwater and the likely sources and so on, to inject into the community discussion.

# How Can We Achieve Lake Water Quality Goals for the Lakes? Economic and Financial Challenges Including Cost Sharing

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## 1. INTRODUCTION

For the past eight years I have taught an undergraduate paper in environmental and natural resource economics. Many of my students are taking a degree in Resources and Environmental Planning and are when they start my course profoundly sceptical that economists have anything useful to contribute to the subject. I assess my success partly by the degree to which I am able to persuade these students that economics does have much to offer, and is highly relevant to the development of policy options that can help society achieve its environmental goals.

I start the course by explaining the economic way of thinking about the environment. I use a text book by Ian Wills who teaches at Monash University. He starts his book with the following paragraph.

*The economic way of thinking about the environment begins with the recognition that environmental problems are people problems. They occur when some people are unhappy with other people's use of the environment. Such failures of social coordination are unavoidable because people are generally self-interested and imperfectly informed about the environment and about other people's wishes. Thus the route to resolution of environmental problems lies through first understanding then reducing these incentive and informational barriers. But the complexities of human-environment interactions, where people are both dependent on the environment and capable of changing it mean that the task will be anything but easy (Wills, 1997).*

I like this quote because it focuses on the need to improve incentives and overcome information problems and because it does not mention the word money, which according to many people is *all* economists care about.

In this presentation I will address two main questions; how can we best achieve lake water quality goals for the Rotorua Lakes and how should the costs be shared? The answers to both of these questions should emerge from the community and all stakeholders, taking into account the advice available from a range of disciplines. My aim in this presentation is to highlight the ways in which the discipline of environmental economics can assist in the development of the best possible set of policies to reduce the amount of pollution entering the lakes.

I will start by characterising the present condition of the lakes using Ian Wills' framework.

<b>Wills (1997)</b>	<b>Comment</b>
<i>"Environmental problems are people problems"</i>	The people of Rotorua and district (and many others) are unhappy with the present condition of the Rotorua Lakes and believe that something should be done
<i>"... some people are unhappy with other people's use of the environment"</i>	Lake users and others who value the lakes are unhappy that people are allowing too much N and P to get into the lakes <sup>1</sup> . There is an additional complication in that the people allowing too much N and P to get into the lakes may also be lake users.
<i>"Such failures of social coordination are unavoidable because people are generally:</i>	
<i>Self interested</i>	Individuals consider the costs and benefits they face as private individuals.
<i>Imperfectly informed about the environment</i>	We did not know that human activity would have such disastrous effects on the lakes.
<i>Imperfectly informed about other peoples wishes</i>	We need better mechanisms to link polluters to those who value a clean lake.
<i>The route to resolution of environmental problems lies through first understanding then reducing these incentive and informational barriers</i>	We suggest that understanding of economics and the use of economic instruments can help reduce these incentive and informational barriers.

Having introduced the 'economic way of thinking about the environment' I will outline the way that environmental economists think about pollution. The economics of pollution control is mainly concerned with two questions; what is the appropriate level of pollution and how should responsibility for achieving this level be allocated?

Economists see selection of the 'best' or efficient level of pollution as being a balancing act between the cost of pollution on the one hand, on users and the natural environment and the cost of pollution reduction on the other. Since pollution reduction has real costs, especially when stringent standards are imposed, the efficient level of pollution is rarely zero. A good example of this is the case of New Zealand's air quality standards. A recent paper (Bicknell & Greer, 2006) found that most of the health benefits from higher air quality standards can be achieved by banning open fires. More stringent measures (banning older wood burners and wood burners in new dwellings) has costs to society that far exceed health benefits.

A particular focus for environmental economists has been the identification of the kinds of policies and instruments that can enable a given amount of pollution reduction to be achieved at least cost. I will talk about this in the second half of my presentation. First I will address the difficult and complex issue of cost sharing.

<sup>1</sup> and have allowed too much pollution to enter the lakes in the past.



## 2. HOW SHOULD COSTS BE SHARED?

I have been asked to address the question of how costs should be shared. It is not surprising that this is a highly contentious issue. Indeed it is probably one of the main concerns of many of the people attending this symposium. I should probably say at the outset that you may find my contribution a little disappointing. This is because economics tends to concentrate on efficiency issues e.g. what is the appropriate level of pollution reduction and how can this be achieved at least cost? The question of how costs should be shared may be addressed through an assessment of who has what rights. Put simply, do people have the right to continue behaving as they have done in the past, in which case they should be compensated if these rights are reduced, or do people have *no* right to harm the lakes by allowing excess nutrient discharge, in which case they should pay for the harm that they have caused? These are not questions that are well addressed by economics<sup>2</sup> since “the question of who has what rights is not an efficiency issue. It is a matter of community ethics and justice” (Wills, 1997).

Nonetheless I can offer you some information and assessment criteria that may be helpful in thinking about how costs should be shared. There are five generally accepted properties of a “good” tax system. These same principles can be applied more broadly to any system of payment for public works.

1. “Economic efficiency: the tax system should not interfere with the efficient allocation of resources.
2. Administrative simplicity: the tax system ought to be easy and relatively inexpensive to administer.
3. Flexibility: the tax system ought to be able to respond easily (in some cases automatically) to changed circumstances.
4. Political responsibility: the tax system should be designed so that individuals can ascertain what they are paying, and evaluate how accurately the system reflects their preferences.
5. Fairness: the tax system ought to be fair in its relative treatment of different individuals” (Stiglitz, 2000, p. 457).

An ‘ideal’ tax does not interfere with the allocation of resources – Margaret Thatcher’s poll tax was designed with this in mind but failed because it ignored the issue of fairness. Most taxes are distortionary to some degree in that individuals can vary their liability by varying consumption, working less, or saving less, but some are much worse than others. The window tax levied in seventeenth century Britain provides an often quoted example of a particularly distortionary tax. Property owners were taxed according to the number of windows in their house. This resulted in bricking up of windows and new houses being built with no windows. The window tax is an extreme example, but many taxes and funding instruments continue to have severe distortionary effects that lead to large losses in efficiency and social welfare. The targeted rate proposed for the catchments of the Rotorua Lakes specifies a flat per hectare rate for each category of land use irrespective of management practices and actual nutrient export. This may lead to productive dairy farms being converted to another land use even though the land is being farmed in such a way as to minimise nutrient export.

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<sup>2</sup> When transaction costs are high, outcomes will be affected by allocation of rights. This topic is covered in the law and economics literature e.g. Cooter & Ulen (2003) – but is outside the scope of this presentation.

If a tax is to be acceptable it needs to be perceived as being reasonably fair. Fairness can be hard to define. Does it mean that individuals who are ‘the same’ should be taxed the same (horizontal equity) – which in practice is hard to implement, because individuals never are ‘the same’. Or does it mean that better off people should pay more? In the case of the Rotorua Lakes, to what extent does limited ‘ability to pay’ justify a higher contribution from central government? To what extent should better off taxpayers in New Zealand as a whole be expected to contribute to cleaning up the Rotorua Lakes? This question is best left to society to answer through the democratic process.

Pollution or clean up taxes (whether based on the polluter pays or beneficiary pays principles) can be viewed as especially beneficial in that they both reduce pollution and reduce the overall costs of the tax system, the so called ‘double dividend’<sup>3</sup>.

### **The Polluter Pays Principle**

When individuals do not bear the full cost of their decisions, resources are misallocated and market failure occurs. The Polluter Pays Principle can provide a remedy by ensuring that individuals bear the full costs of their actions including any negative externalities<sup>4</sup> their actions may impose on the community through environmental damage (Aretino, Holland, Matysek, & Peterson, 2001). The Polluter Pays Principle was adopted by the OECD in 1972 and “requires individuals to meet the full costs of their actions, requiring them to bear the costs of implementing pollution prevention and control measures necessary to maintain the environment in an ‘acceptable’ state” (Barde, 1994).

One of the main reasons for OECD adoption of the PPP was “to ensure that environmental policies in different countries are based on a common cost allocation principle ... In fact, the PPP can be defined as a non subsidy principle” (Barde, 1994). It is intended, for example, to ensure that New Zealand farmers who may face extra costs in ensuring that they do not allow excess nutrient export from their farms, do not find themselves competing with farmers from other OECD countries who do not face such costs.

It would be a mistake to assume that the main purpose of the PPP is to ensure that polluters *pay* for the cost of any pollution that they pass on to third parties. The most important feature of PPP is that it ensures that the price of marketed goods reflects their full social cost. For example if lakeside houses and agricultural products have ‘social costs’ e.g. loss of lake water quality, then the cost of lakeside houses and agricultural products should reflect this. Thus the primary purpose of PPP is to inject price signals that reflect environmental costs into the economic system (Barde, 1994).

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<sup>3</sup> “refers to the notion that environmental taxes can both reduce pollution (the first dividend) and reduce the overall economic costs associated with the tax system by using the revenue generated to displace other more distortionary taxes that slow economic growth at the same time (the second dividend).”  
[http://glossary.eea.eu.int/EEAGlossary/D/double\\_dividend](http://glossary.eea.eu.int/EEAGlossary/D/double_dividend)

<sup>4</sup> Externalities are “consequences (benefits or costs) of actions ... that are not borne by the decision maker, and hence do not influence his or her actions” (Wills, 1997) e.g. pollution.

It is important to understand that who actually bears the cost<sup>5</sup> under PPP depends on the market, not on the decisions of the regulatory authority. Consider the example of a pollution tax that increases the costs faced by farmers in catchments of the Rotorua Lakes. These farmers are generally ‘price takers’, so they are not able to pass on the tax by raising their product prices. They will directly bear the full cost of any pollution charge. On the other hand a luxury lodge facing a pan charge<sup>6</sup> may be able to pass on all of this cost by increasing its charges. In this case consumers (including international visitors) pay the charge. It is the market that influences who bears the cost, depending on how consumers respond to price changes. In the case of farm products demand is highly elastic such that farmers cannot pass on any of their additional costs, whereas demand for luxury accommodation at an established lodge may be quite inelastic in which case the pollution charge can be passed on to consumers, rather than being paid by the owners of the lodge.

PPP can be implemented through regulations, charges or tradable rights or permits.

- Regulations that require resource users to bear all costs of undertaking remedial action; or to refrain from actions that have an adverse impact;
- Charges levied on environmentally harmful outputs, inputs or practices; or
- Tradeable Rights or Permits that must be purchased by the polluter. These will be described later.

### **Beneficiary Pays Principle**

The Beneficiary Pays Principle (BPP) also known as ‘user pays’ and ‘victim pays’ requires anyone who benefits from an activity to contribute to the cost of undertaking it. Pollution reduction may generate private benefits to individuals or groups; and public benefits to ‘the community’. It may be appropriate for individuals/groups to contribute to activities that benefit them; and for government to contribute on behalf of the general community. Under BPP we might estimate the extent to which the benefits of cleaning up the Rotorua Lakes would accrue to the district, to the region and to the nation as a whole. We would then allocate the cost cleaning up the lakes in these proportions.

BPP may encourage efficient resource use by requiring beneficiaries to pay for the cost of clean up. Without a pricing system, user demands can be excessive and more than the optimal level of clean up activity can occur. On the other hand too high a level of subsidy from government can reduce incentives for firms and households to adopt environmentally friendly practices (Aretino et al., 2001).

I have outlined some theory and evidence from the economic literature on the subject of who should pay<sup>7</sup>. This is a very contentious area and one where the final solution needs to be decided on the basis of extensive consultation with all stakeholders and careful analysis of the costs and benefits of alternative approaches. David Pannell (2005) of the University of Western Australia provides an excellent quotation on which to wrap up this part of the presentation.

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<sup>5</sup> This is called ‘tax incidence’, see Stiglitz (2000, p. 258).

<sup>6</sup> Typically a variable component of property rates based on the number of toilets in a property.

<sup>7</sup> The issue of who should pay for legacy pollution is covered by other speakers.

*“.. Neither ethics nor economics solve the problem of who should pay for environmental protection. They offer relevant considerations and helpful information, but the final decision is necessarily made subjectively, in the political arena, based at least in part on views about rights and fairness.”*

### 3. HOW CAN RESTORATION BE ACHIEVED AT LEAST COST?

Suppose we have agreed on an appropriate standard for the lakes and have worked out the reduction in nutrient inflow to the lakes which is required to meet that standard. Economics can help us to identify the best way to achieve this target at least cost. In particular, *economic incentives* can minimise total abatement costs by equating marginal abatement costs<sup>8</sup> across polluters. In addition, economic incentives can encourage more R&D into abatement activities and alternatives to activities that generate pollution. For example farmers may be encouraged to manage their farms in a way that minimises nutrient export and may also identify alternatives to pollution generating activities.

These concepts can most easily be explained by means of a simple example. Suppose that pollution in a catchment originates from a sewage treatment plant, ten dairy farms and one hundred lakeside houses. Assume also that each source can reduce their nutrient emissions, using available technology and management practices and that the unit cost of emission reduction varies from \$5 per unit (the sewage treatment plant) to \$30 per unit (lakeside houses). Suppose that the authority wishes to reduce emissions by 50%. A simple regulatory approach might require each source to reduce their emissions by 50%, see Table 1.

**Table 1: A Regulatory Approach**

Source	Annual Emission (Units)	Unit Cost	Total Cost if all reduce by 50%
Sewage Treatment Plant	100	\$5	\$250
10 Dairy Farms	60	\$10	\$300
100 Lakeside Houses	40	\$30	\$600
<b>Total</b>	<b>200</b>		<b>\$1,150</b>

*Note: This is a simple example using imaginary data*

The least cost approach to achieving a 50% reduction would aim to equate marginal abatement costs across polluters. Pollution reduction would be undertaken by the lowest cost source until their costs reach the level of the next lowest cost source and so on<sup>9</sup>. In this case all of the clean up would be undertaken by the sewage treatment plant and a 50% reduction in emissions would be achieved for \$500 which is less than half the cost of the regulatory solution.

<sup>8</sup> The cost of abating (cleaning up) one more unit of pollution.

<sup>9</sup> The example is somewhat oversimplified in that the unit cost of clean up is assumed to be constant. In the real world the unit cost of clean up (marginal abatement cost) tends to rise with the quantity of abatement.

**Table 2: Least Cost Approach**

Source	Annual Emission (Units)	Unit Cost	Units Abated	Cost of Abatement
Sewage Treatment Plant	100	\$5	100	\$500
10 Dairy Farms	60	\$10	0	\$0
100 Lakeside Houses	40	\$30	0	\$0
<b>Total</b>	<b>200</b>		<b>100</b>	<b>\$500</b>

The savings demonstrated in this simple example are backed up by a wealth of evidence showing that poorly designed regulatory programmes often have costs that are several times greater than would have been the case with the least cost approach. Table 3 summarises some findings from Field (1997, p. 307).

**Table 3: Regulations vs. Least Cost Pollution Control Programmes**

Pollutant	Area	Regulations: Least Cost
Particulates	St Louis	6.0
SO <sub>2</sub>	Utah	4.25
Sulphates	Los Angeles	1.07
NO <sub>2</sub>	Chicago	14.4
SO <sub>2</sub>	Delaware Valley	1.8
Particulates	Delaware Valley	22.0

It can be seen that the regulatory programme adopted for particulates in the Delaware Valley had costs twenty two times greater than the least cost method of achieving the same pollution reduction and control of NO<sub>2</sub> in Chicago, cost fourteen times as much as the least cost policy. On the other hand the cost of the regulatory and least cost programmes was more or less the same in Los Angeles. This is because there was little difference in the abatement costs of different sources, so the regulatory approach achieved almost the same outcome as the least cost approach.

Cost effective pollution policies should ensure that the cost of the last unit cleaned up should be about equal across all sources. Policies that follow this rule have the potential to achieve very significant cost savings. Most regulatory approaches do not take account of variation across polluters and so do not minimise the cost of pollution reduction. More expensive policies are likely to encounter more resistance and so will be less effective in achieving community goals. One way of ensuring that pollution reductions are achieved at least cost is through nutrient trading.

#### 4. NUTRIENT TRADING

Under nutrient trading programmes<sup>10</sup> the control authority first determines a limit (or cap) on the amount of nutrients that may be exported into surface or groundwater. It then allocates or sells limited rights (permits) to polluters to emit at this level. The owners of permits can buy, sell and lease them as they wish, within the rules of the trading scheme. Indeed it is important that mechanisms are set up to encourage and facilitate trading if the cost savings and efficiency gains associated with trading are to be realised. Appropriate mechanisms for monitoring and enforcement must be established, as with any pollution control policy.

An example of nutrient trading is provided by the Tar Pimlico Watershed, North Carolina, USA, see below.

##### Nutrient Trading in the Tar-Pimlico Basin

*“In 1989, the North Carolina Environmental Management Commission designated the Tar-Pamlico basin as nutrient sensitive water. The formal designation required the state Division of Environmental Management (DEM) to identify the nutrient sources, set nutrient limitations, and develop a nutrient control plan. The DEM analysis showed that most of the basin’s nutrient loadings (primarily nitrogen, but also phosphorus) came from agricultural runoff and other non-point sources. Other sources include municipal wastewater treatment plants and industrial and mining operations.*

*The agency originally recommended regulations to halt point source pollution increases. A coalition of point source dischargers then formed the Tar-Pamlico Association, proposing emission trading as an alternative to control water pollution. The Association’s proposal had two important components. First, the aggregate nutrient load of the Association as a whole would be regulated, thus allowing for trading between its members as long as the Association’s cap was achieved. Second, members of the Association could pay into a fund that would pursue nonpoint source reductions to offset any loadings beyond their allowed levels.*

*As a result of the association’s proposal, two types of trading take place in this program. One is PS-PS trading via bilateral negotiations between members of the association. The other is PS-NPS trading via a water quality clearinghouse between members of the association and farmers. This clearinghouse, managed by the NC Agricultural Cost Share program, pays farmers 75 percent of the cost of implementing best management practices (BMPs) that reduce runoff of nitrogen and phosphorus. By 1996, members of the association had purchased \$900,000 worth of credits, with \$750,000 being contributions to the fund (Green 1997)”.*

Source: Nguyen, Matlock, Denzer, Faeth, & Selman (2005)

The World Resources Institute provides an excellent source of information on nutrient trading including ‘*Fertile Ground: Nutrient Trading’s Potential to Cost-Effectively Improve Water Quality*’ (Faeth, 2000). This document reports simulation results for nutrient trading in three watersheds in the upper Midwest of the USA. In the Minnesota River catchment it was found that the least cost solution achieved the same result as the regulatory approach (point source performance requirements) at an average cost per unit of phosphorus removed of NZ\$14.81 compared to NZ\$66.46 for the regulatory approach. Across the catchment this resulted in annual cost savings of over NZ\$11 million, see Table 4.

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<sup>10</sup> Also known as ‘cap and trade’ and tradable emission permits.

**Table 4: Minnesota River (Simulation Data)**

	Point Source Performance Requirement	Subsidies for Best Management Practices	Least Cost Solution
Total P Reduction	20%	20%	20%
Point Source P Reduction	70%	0	30%
Agricultural P Reduction	0	30%	17%
Total Cost (NZ\$/M/yr)	14.74	12.4	3.31
Average Cost NZ\$/Kg P	66.46	55.32	14.81

Source: Faeth (2000, p. 34). US\$ Converted to NZ\$ at US\$0.65=NZ\$1

The conditions under which nutrient trading works best have been well summarised by the U.S. Environment Protection Agency. Trading works best when:

- Polluters have a strong incentive to try to reduce pollution (often through imposition of a cap);
- Different sources have significantly different pollution control costs;
- Necessary reductions are not so large that all sources must reduce as much as possible – there must be a surplus of possible reductions available for trade; and
- Stakeholders and regulatory agencies are willing to try an innovative approach (U.S. Environmental Protection Agency, 2006).

### Who Pays Under Nutrient Trading?

Nutrient trading systems must be designed to meet the characteristics of particular watersheds and the requirements of stakeholders. They can be designed so that all costs are borne initially by polluters, or so that all costs are borne by the taxpayer, or various combinations of these two options.

- Option A – Taxpayers bear all costs  
All sources are allocated permits based on existing activities. Taxpayer funds are used to buy permits at market rates in order to reduce pollution to the target level. This may be done by calling for tenders whereby sources that wish to participate would offer to reduce x units of pollution for a specified price. The authority accepts tenders until the target reduction is achieved, starting with those offering pollution reduction at least cost.
- Option B – Polluter Pays  
All sources must buy permits at the market rate in a competitive bidding process organised by the regulatory authority. Funds raised in this way may be used to fund clean up activities.

- Option C – Cost Sharing – *An Example*

All sources are allocated permits at a level that would allow 90% of existing nutrient discharge. Sources can either modify existing activities to reduce nutrient discharge or try to buy permits from other sources. Taxpayer funds are used to buy an additional 10% of allocated units in order to bring nutrient discharge down to 80% of previous levels.

Use of market instruments, including nutrient trading is sometimes opposed based on incorrect preconceptions. The Nutrient Net website aims to correct some of these before they occur under the general heading ‘what trading is not’.

- “Trading is *not* a substitute for a regulatory framework. It is a policy tool that can be used alongside regulation...
- Trading is *not* a way of letting the market decide environmental outcomes. It is a way of achieving water quality goals most cost effectively.
- Trading does *not* ‘let polluters off the hook’. It does allow sources facing high pollution reduction costs to purchase less costly reductions from other sources; but the reductions must be made and paid for.
- Trading does *not* exclude other policy approaches. Trading can be used in conjunction with other policy tools such as targeted subsidies, mandatory best management practices or public education campaigns.” (World Resources Institute, 2006a)

## 5. CONCLUSIONS

The economics literature provides assessment criteria and principles that can assist in deciding who should pay to clean up the Rotorua Lakes. The polluter pays and beneficiary pays principles are particularly relevant and it is likely that the final cost allocation will be based on these principles. The final decision will necessarily be made subjectively, in the political arena, based at least in part on views about rights and fairness (Pannell, 2005).

Appropriate use of economic incentives has the potential to allow large savings in the cost of cleaning up the Rotorua Lakes. Overseas examples demonstrate that the cost of the regulatory approach is often several times greater than the cost of the least cost method of pollution control. Nutrient trading provides an excellent mechanism that can assist in achieving pollution reduction at least cost.

New Zealand has played a leading role in the use of economic instruments to facilitate sustainable management. The Quota Management System provides an excellent example of the careful use of markets to produce outcomes that are both good for the environment and economically efficient. The QMS is noted internationally as a world leader in the area of fisheries management. Economic instruments, including nutrient trading, are being used to improve water quality in a growing number of countries around the world. A variety of resources are now available to facilitate the introduction of nutrient trading. The United States Environmental Protection Agency recently published a handbook to assist in establishment of water quality trading systems (Environmental Protection Agency, 2005) and the World Resources Institute, based in Washington, has developed NutrientNet, a web based trading system that is being used in the Kalamazoo River and Chesapeake Bay/Potomac River watersheds.



NutrientNet aims to provide “a simple way for buyers and sellers to connect, by making it relatively easy for both point sources and non point sources to estimate their remediation costs using standard, consistent methods, and by making the record of trade readily accessible” (World Resources Institute, 2006b). Establishment of mechanisms that encourage and facilitate trading is essential, if the cost savings and efficiency gains associated with trading are to be realised. Detailed research and analysis over the last few years has provided a solid foundation from which New Zealand can move forward and make more use of economic instruments such as nutrient trading, while taking careful account of the characteristics of New Zealand’s social and economic environment. The use of these instruments has the potential to allow major costs savings thus helping greatly with the effort to clean up Rotorua Lakes.

## QUESTIONS

*Brian Bell, Nimmo Bell:* Dan that was a fascinating talk, thank you very much. You brushed over the issue of grand parenting or averaging for allocating rights to pollute. This is a very contentious issue – is there anything that economics can tell us about how to resolve this dilemma?

*Dan Marsh:* Well as you rightly judged, I tried to avoid that questioning because I know that that is really the one that everyone wants to argue about. I think that if we were considering that issue for Rotorua then we would need to carefully analyse what would happen in the two cases. I think really we have to closely look at it. If we look at Taupo, what has happened is basically grand parenting. I was saying to someone at dinner yesterday that if you had asked me this question twenty years ago when I left University, I would definitely have said averaging. I would have had a sort of egalitarian view of the world and I would have said that the polluters never had the right to pollute, the right to emit nitrogen should be distributed amongst all and so I would have gone to averaging. Nonetheless, obviously that has high costs in terms of say, disruption to farmers who are currently emitting. So if you ask me now, I would say irrespective of the rights or wrongs, most governments or regulatory authorities are likely to go to grand parenting because it causes the least disruption. But to actually answer your question, I think we should look carefully at what would happen in the particular case and then formal assessment in consultation with the community.

*Sandra Barnes, Environment Waikato:* When fisheries used a similar system as cap and trade, the price of quota, the right to catch fish, went through the roof, higher than anyone had ever anticipated. One of the reasons it seems to me is because it gave basically a perpetual right to catch fish as long as the fish were there. When you have thought about this issue with the nutrient trading, what have been your thoughts about the length of time that the permits would be for? Thank you.

*Dan Marsh:* Off the top of my head, I would think that the permit could be the right to pollute in perpetuity. But supposing you owned that right, you might choose to lease it; so you might lease it to someone for a year. But the other thought I also have is that you can write some rules on the back of that permit, for example, the right not to have met a specific tonnage of N or P, it might be the right to emit a particular proportion of the cap. So for the sake of argument, if it is decided this year that we work towards 100 tonnes and you have a 100<sup>th</sup> share, that allows you 1 ton, it may be warned that in the future that cap might be

reduced to 80 tonnes in which case your share is now only worth 80%. There are a whole lot of ways you could do it and for the particular case, you have really got to look at these caps and work it out in consultation.

*Paul Dell, Environment Bay of Plenty:* I think the issue of trading is certainly something we are looking at and we have been quite successful I think with Rotorua geo-thermal field. But the reality there was that it went through bore closure; you know there had to be a real hard front end to push things down to a sustainable level. It seemed to me that when you talked about a cap, I mean the reality for us at the moment is to put a cap in place but we have still got to get rid of something in the order of between 250 and 350 tonnes of nitrogen. The way I have heard you, really until you get to the point where you have set that level, you can not really start your trading can you; otherwise what are you actually trading? You are just moving the nutrients from one part to the other in the catchment, you are not actually removing them.

*Dan Marsh:* I am a little bit cautious of pronouncing too strongly, but my initial thoughts were that perhaps you do not have to go that slowly because you could switch to a tradable permit system which really does not change anything much as your first step, i.e. instead of being allowed to fertilise as you do now, you now hold a tradable permit. As you develop more information, you can go into the market and try and reduce permits, assuming you have got enough money available. For example, you may even call tenders. We are willing to buy 100 tonnes of N reduction this year, people are invited to put in and say at what price they are willing to sell their permits. So you do actually have quite a lot of flexibility, you can decide on how far down you are going over time.

*John Green, LWQS:* Thank you very much for that presentation Dan, I think it was excellent. I can understand the trading situation and I can understand Paul's issue that obviously we want to get the nutrient levels down and therefore, a market that is going to decline might have quite different dynamics. But how do you deal with the six metres of pollution that is sitting in the bottom of Lake Rotorua which is going to emit so much pollution for the next 200 years? Is there an economic solution to that or is just purely a cost decision?

*Dan Marsh:* Well there is not an economic solution, economics simply helps us to try and work out the least cost ways of achieving goals. Perhaps I was being a little bit simplistic when I was saying things like \$200 for Phoslock as compared to a cheaper amount of money for farmers, because if the Phoslock has to be used to get rid of the capital P and that is the only way of doing it, then maybe that is the money you have to spend. In short, I am not sure I can really answer your question right now. Perhaps we should talk about it afterwards.

*Rowland Burdon – Royal Society of New Zealand:* Would not any change in the payment regime tend to generate distortions. What I am thinking of is, for instance under polluter pays, the polluter might be faced with these additional costs but at the same time the polluter might be caught with a double-whammy having paid an inflated capital cost based on a regime before the payment system was imposed.

*Dan Marsh:* There is always the risk of distortions but usually we think of some mechanism that encourages polluter pays as reducing distortions, because we see the distortion as the fact that people at the moment are not paying for their pollution and we see that we were reducing

that distortion by getting people to pay for that pollution. But to the extent that markets may not operate too well, perhaps there are too few traders and perhaps it is hard for them to deal with each other and sometimes the prices might vary a lot – sure there would be a risk of distortion but whether it would actually be worse distortion than we have now, I hope not.

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## **The Government's attitude to the restoration of the Rotorua Lakes**

Barry Carbon

*Chief Executive, Ministry for the Environment*

*Barry Carbon has been Chief Executive for the Ministry for the Environment for two and a half years. Previously he has held equivalent positions with Queensland, the Australian Government and Western Australia with a distinguished career in environmental management. He has been Supervising Scientist for the Alligator River Region, managed environmental affairs for Alcoa and was a scientist with CSIRO. He is leaving New Zealand for Western Australia after four years as Chief Executive*

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*Barry presented the speech that was to have been given by the Hon David Benson-Pope, Minister for the Environment. The italics are the Minister's words, not included in Barry's speech.*

### **TRANSCRIPT**

Thank you very much. This would have been a great speech if it was yesterday morning and it was a great speech if it was read by David Benson-Pope, but I have the Minister's speech here. I am not good at reading other people's speeches so I am going to try to do it quickly so you can ask me any questions on any topic at all at the end.

Let me start with a genuine apology – you will all be aware that David Benson-Pope's had more hits than a tennis ball at Wimbledon over the last couple of months and I guess the normal reaction would be that you would say, "has he gone to ground", "he's hiding" and all that sort of thing. The reverse is true and I get to work with a lot of police so I understand this pretty well; right now under times of pressure is when people like David would like to be seen out in public going about their normal job. He has got a few pressures on – not only did he announce a significant change in structure yesterday with Child Youth & Family, also under his control, which is to be melded with the Ministry of Social Development. That is a huge, huge part of the nation's expenditure and indeed, staff numbers; but he has got some other things on today which will become obvious later on. So he has been very busy and he genuinely apologises. Some of the speech I have here is written by staff of course, but some is also written by him because he genuinely thinks this topic is important.

New Zealand rightly takes great pride in clean water, rivers, lakes, streams. Indeed, I am struck when I come to these symposia seeing people from other parts of the world, and indeed, I came from other parts of the world – talking about water as a resource because it is more than that here. It took me a while to understand that clean, fresh water is more than a value system really, it is something that flows through the veins of all kiwis. So it has not only economic prosperity, health, environment, but it is part of kiwiville; it's important in home, work, farm, and factory. Water is vital to the functioning of our communities and the industries on which those communities depend.

By world standards the water in New Zealand is good and it is hard for people who face problems like you to accept that, but the water in New Zealand is absolutely amazing. The *2003 UN World Water Development Report: Water for People, Water for Life* ranked New Zealand third for water quality out of 122 countries (after Finland and Canada). However, I think we have more issues with quality than we have with quantity. Abundant rainfall, thousands of streams, 70 major rivers, more than 770 lakes and numerous underground aquifers containing cool groundwater or hot geothermal water. Do you know if you put the rivers together from New Zealand, they would stretch halfway to the Moon. Now that is a totally unimportant suggestion, but if you have grown up in a dry country like I have, there are rivers everywhere here and that is not only nature, it is a credit to New Zealand. I will come back to that.

We have prospered from our consumption and use of water, and by discharging our waste into it. It was sort of like the environmental good, we discharge that stuff into the atmosphere and discharge things into the water, because it was then the economic thing to do. But our fresh waters are under pressure – and particularly in areas where land has been developed for pastoral agriculture and where urban populations have established. Our country's lakes and rivers feature prominently as tourism attractions and are critical to the current and future success of this industry. We understand from the Tourism Board that two and a half million people last year came to New Zealand.

Now the notes here say the Government is committed to maintaining the quality of our environment for preservation of New Zealand's unique bio-diversity. Clean air, open space, and good water quality are seen as our birthright. Now that is what you would expect the Minister to say I suppose. I tell you, I have been involved in the last six months trying to work with Government to work out what value systems they going to put behind this issue of climate change. Because climate change is tough, there is no good news in climate change, and the guidance we are getting reinforces this quite strongly over the last two weeks.

The first thing is that the environment of New Zealand is a birthright and there are some tough things we have to do about it, but it is a birthright and it is something that will be done. But reality does not always conform with this ideal and the Rotorua lakes are probably one example of it, but not the only one. Let me give you some context for the state of our freshwaters.

As you know we have streams up in mountains, the great quality of them and sparsely developed upper reaches are good, but as the rivers get close to the ocean, they decline measurably in the middle and lower parts of catchments in nearly every part of the country, whether highly urbanised or intensively farmed. We have thirty or so large deep lakes that are generally of high quality. However, more than 700 are shallow lakes and at least 10 percent (70 to 80) of them are nutrient enriched and struggling. Most of the nutrient enriched lakes are in the North Island and in pasture dominated catchments.

There are other places in the country where studies are occurring, Omakere in Northland, Wairewa and Te Waihora in Canterbury, Horowhenua near Levin, Tutira in northern Hawkes Bay, Brunner in Westland and our largest lake, Lake Taupo. The issue is probably most acute here but it is an issue across the country. Brunner and Taupo are still in reasonably good condition and even Horowhenua has improved since sewage discharges from Levin

have been diverted from the lake to land disposal in 1987. But the lake is still prone to some blue-green algae.

Everybody knows the backbone of the economy of the country has been, and will continue to be, our primary industry. But because of the scale of pastoral farming, agriculture outranks all other sources of pressure on our water quality. This is very, very much in Government's eyes. If you go back to the parallel I gave you about climate change, climate change is a really pressing issue and our contribution to it is important, but Government said it is too difficult an issue to charge in and say this is what we are going to do with agriculture.

Nearly all of our catchments have been developed for pastoral farming. This development has damaged many surface water bodies and some groundwater with sediment, animal wastes and nutrients. You all know about the efforts Fonterra is trying to do to improve its image associated with impacts of the dairying industry on streams. *While improvements have, and are being made as the agricultural sector responds to the issues and as water treatment technologies have improved, there is still some way to go.*

Urban development has also had an impact. Rotorua, for example, with a population of 69,000, is the largest settlement on a lake in this country and as you know, for nearly 100 years the septic sewage was disposed into Lake Rotorua. Now it was likely that that was thought to be the least cost approach then. To us, in the 21<sup>st</sup> century, that seems a startlingly short-sighted move.

In the late 1980s Central Government in different funding systems, before the big devolution, the big cost shifting that occurred, provided \$30 million to assist in diverting the sewage to land treatment. Since then the nutrients in the Rotorua water have significantly reduced but, as you know, we are still living with the legacy of the past in the form of polluted sediments.

We have made some real progress in recent years to reduce direct discharges of sewage and industrial waste direct into streams, including better on-farm practices that reduce the adverse impacts of dairy shed discharges. But, and as everybody said, we still face the more difficult issue of effectively dealing with “non-point-source” discharges. *It is a complex issue. We must learn to develop solutions that are better than trade-offs, that improve economic performance, as well as enhancing the quality of the environment and the way we live.* As the other speakers have said, this is not only important for New Zealand but all across the world.

Now I want to give you a bit more perspective, and this is really to compliment the country. Managing water quality has been a regional responsibility under the Resource Management Act. I know the Resource Management Act gets a fair bit of belting around the place; but let me tell you about the situation that it gives us, and this is a credit to Regional Councils, they are explicitly empowered under the Act to control land use to maintain and enhance water quality. Most countries in the world would die to have the environmental flows that Local Government, Regional Government has managed under the Resource Management Act.

The flows question, alright we have got some problems in Canterbury, and some over-allocations where people had an adventurous look at the rules around the place, but water flow in the country compared to just about everywhere, we have done brilliantly. The crunch time is arriving where we're going to have to ask some hard questions, but from the point of

view of water flow, we have done brilliantly. *The devolution of functions to communities of interest is an important feature of the Resource Management Act. It is based on the premise that the most effective solutions are likely to be developed and applied from within the community and not necessarily imposed from the outside.*

It is the quality one that is starting to hurt us, quality and as I said RMA has been a reasonably good tool to manage the point source, it is the diffuse that it is done. That said, the national response to managing water quality issues is being addressed to the Sustainable Water Programme of Action. This is a work programme that has been going for almost three years. *Officials at the Ministry for the Environment are leading a cross-agency group of senior officials, working with local government to improve water management across all regions.*

*The Sustainable Water Programme of Action is focused on three key elements: managing the growing demand for our freshwater resources, managing water quality and developing policies to manage our water bodies of national importance. Policies for ensuring long term benefits from water management will be developed.* It is about to be presented for Cabinet for decision-making, and people are taking a deep breath, they're sucking wind through their teeth going, "do we really have to face up to this one?". As you know, there are some real tough issues out there. If you're looking at things like economic instruments, you have to face up to questions about "if we're going to have trading, that really means ownership?" "Do we really want people to own water?" "Do we want them to own it in perpetuity?" "Do we want them to own the rights to pollute?" Well in little ways those things have been faced up to.

The two speakers you have just had might be interested to know that the air quality model, we have fourteen standards for air quality in the country, and in those places where there is a pollution associated with fine particles, there's a cap and trade system in place. There is a target from where they are now, down to a cap at a certain standard level, and the people underneath that, in order to get resource consents, are allowed to trade. For example, in Auckland if you wanted to expand your factory which sends out fine particles, you are allowed to go out and buy two new diesel buses and replace the smoky old buses. That is a cheaper way of getting the reduction in emissions. The system is there, the system is doable, but it is hard.

Now a water programme focusing on managing the growing demand for fresh water – that's doable; managing water quality and developing policies to manage our bodies of national importance – and that's of vital interest to you. *Policies for ensuring long-term benefits and water management will be developed. The Ministry is working closely and effectively with regional councils, industry and science agencies to develop the tools and techniques needed to manage complex land use and diffuse nutrient discharge problems.* The Ministry for Environment has already made significant commitment to addressing water quality issues, including lakes water quality, through its Lake Taupo, Rotorua Lakes and Sustainable Water Programme of Action programmes. Water allocation in Waitake is part of this continuum, as indeed the Fonterra Clean Streams Accord and I am specifically calling it the Fonterra Clean Stream Accord because this **will** work if they drive it. "It's them, it's theirs".

*The Fonterra Dairying and Clean Streams Accord is one of New Zealand's most important environmental agreements. Its signing demonstrated a real partnership between central*

government, local government, and the dairy industry to improve environmental performance – and move “beyond compliance”. Fonterra’s farmers are working to targets to keep dairy cattle out of streams, lakes and wetlands, to treat farm effluent, and to manage the use of fertilisers and other nutrients.

*It is still early days and there are still areas for improvement, but the results so far show that dairy farmers are making good progress towards clean healthy streams under the Accord. And farmers are increasingly aware of the environmental consequences of their activities.*

The Government has already committed \$36.5 million towards the \$81.5 million programme to improve Lake Taupo. *Environment Waikato and the Taupo District Council have committed to funding the remainder.* You might ask me afterwards, why have they got money and you guys have got less? I will have a look at that. The Taupo programme is the first in terms of seeking to manage excess nutrients from diffused nutrients; and it is as much a challenge as this one. *It offers us the opportunity to tackle the difficult problems of managing excess nutrients from diffuse sources in a new way. The project aims to protect a high quality environment, while at the same time promoting economic development to sustain the social and cultural values of the community. It is a challenging task but we are making good progress and valuable lessons are being learnt. Indeed, lessons and techniques that we hope can be applied to other catchments and resource issues in the future.*

The Ministry for Environment has been closely involved in the Rotorua lakes project since late 2003. It engaged Dr Bruce Hamilton, an Australian expert, to evaluate the range of current proposed potential actions for the Ministry's funded land use initiatives through the Sustainable Management Fund *to manage the short-term symptoms and causes of water quality problems in Lakes Rotorua and Rotoiti.*

We put our hand up at the budget stage and looked at the money for the Ohau Channel diversion and where we thought it was going to cost about \$4 million, it is probably looking like double now. There is the \$10 million research programme over ten years *through the Foundation for Research Science and Technology*, which you are all aware of; so the Government's not been backwards at putting its hand in its pocket, but it is not committing blindly to something that does not quite know where it is going to go yet.

We have got the land use initiatives *through the Sustainable Management Fund.* The Minister was here in January to meet with the Lakes Joint Strategy Committee and he met with Te Arawa people and he has got a significant involvement and specifically asked me to pass on to you his extreme interest in this issue. *The Minister commends the Joint Strategy Committee for the leadership it is demonstrating in seeking solutions for the lakes long-standing water quality problems.*

*The committee presented the Minister with its proposals for the lakes and provided him with a current estimate of the likely costs to implement its water quality improvement programme over the next decade or so. While he could not commit to further Central Government funding at this stage, he did ask his officials to provide an opportunity for council staff to present the committee's proposals to officials from other government agencies. He understood that such a meeting was held in Wellington last week.*



Now his comments here say that the water quality issues to the lakes are complex and the water quality of the lakes has been declining for decades; and the Ohau Channel diversion is part of an approach that says, “this is what we think is the right thing to do” but is it the right thing to do.? It is a one step at a time approach. *Addressing the water quality issues of the Rotorua Lakes is not just a question of funding.*

Addressing the sources of the water quality problem in the lakes and providing the most enduring solutions will involve land use changes in the catchments and this is going to be tough; and it will take time and involvement to develop and implement such programmes. EBOP’s planning rules and the on the ground work of the Rotorua Lakes and Land Trust, through its funded initiatives, is a positive start. The outcomes of the Sustainable Water Programme of Action, *and the lessons learnt from industry initiatives and the Lake Taupo programme will also help.* But this is tough, it is really very, very tough to try and develop some sort of magic bullet that works right across the country, when many of these things are in fact location specific.

Now the Minister asked me to pass on that the Government is committed to maintaining the quality of our environment and the preservation of bio-diversity. We have made some real progress in recent years dealing with direct discharges, but now the hard yards are in front of us. It’s an issue that highlights the need for collaboration. Neither the Government nor any single player can resolve it.

The Minister asked me to finish on wishing you well with your symposium, but I want to add a little comment of my own. I think that there are lots of examples around the world, just across the ditch in Australia, or Canada or Europe where they have looked at these issues. They have looked at issues where I think the values are parallel but not the same as here. I think, as I indicated earlier, that the values that New Zealanders hold on clean fresh water go beyond tourism, they go beyond resource use, they go beyond irrigation, they go beyond hydro, they go beyond industrial water sources; they are in fact something that runs very deeply through the veins of kiwis. So I would suggest that you take little steps, I suggest that you take one step at a time and use an adaptive management approach, do not dive into this because (and I am not talking economics), the costs of getting it wrong are bad and the eyes of the country are on you; you are out there leading and the rest of us are going to learn from you. Good luck.

## QUESTIONS

*Don Atkinson, LWQS:* Firstly, thank you for the address, I found it very interesting and certainly we acknowledge the funding that Government has initially provided to get this process effectively happening. But Government effectively have had control of these lakes for 100 years and unfortunately the legacy of that control is now being borne by us all and the district as a whole. I think to be engaged in this process, Government needs to accept that it effectively did control the lakes while the pollution effectively occurred, the legacy that we are effectively facing today is something that you cannot really take responsibility for if you remain in Wellington and only come up and occasionally interface with us. These lakes are really such an important lake system for the whole of the country. The issue is absolutely critical and Government need to be involved in the process on a monthly basis; they should be meeting with Te Arawa, Rotorua District Council, Bay of Plenty Regional Council on a

regular basis and taking ownership of the problem which they in actual fact oversaw. What's your response to that?

*Barry Carbon:* Thanks for that. First of all, let me concede that I think the Rotorua lakes system is not only important locally, but nationally - and so is Omakere and Brunner and ... there are about ten of them out there that are real issues. I actually do not think our system, and it has been our system for fifteen years now, is going to be one where the Central Government is going to be, or seen to be, the drivers in most circumstances and indeed, the philosophical view behind the big devolution that occurred through the late 80s was that these are issues that the system expected local people to be given the power to make local decisions. That is the whole fundamental behind the Resource Management Act - that has worked. There was a time when we experts lived in Wellington and the managers lived in Wellington and now we have about twenty centres of excellence across the country and they are all very good - better than we are in Wellington at management, seriously - they are better, they have more knowledge and they have more capacity.

There are a whole series of environmental issues, in Fiordland for example there are fishing issues and there are other resource issues. The model that has been successful is one where the local people get together and say this is what we want to have happen and this is how we want to be involved in both the managing and cost sharing of it, and they then go and talk to Central Government about it. Pack your bags, go to work. But it is highly unlikely I think in the future that Central Government will either just say here's a packet of money, or Central Government will go out and become the managers. Now we have a Prime Minister who keeps saying "I'm not going to take the local out of local government, I expect people in New Zealand to have the capacity to manage and be responsible for their own fates".

*John Green - LWQS:* Thank you for your address and I am not going to sing the song Fly Me to the Moon ... halfway! You touched on the issue of iconic status of various assets around this country. I am just disappointed that we did not actually ask ourselves another question that we would like a presenter to give, and that is what happens to the New Zealand economy when Lake Rotorua and Lake Rotoiti die? Could you please tell me what you think will happen to the New Zealand economy when those two lakes die because we cannot afford locally to pay for it. Because at the moment, you've talked about devolvement of Central Government responsibility to Regional Government, but when I look at what the Regional Government are doing - they are targeting the rates back to the residents of Rotorua who cannot afford to pay for the lakes.

*Barry Carbon:* I sincerely hope that none of the major lakes in the country die; I think that would be a tragedy. I also think that there is no view I have heard in Wellington that anyone else thinks that the lake system should die and indeed, if you look at the efforts and contributions that have been shown over the last four or five years, including recently, the people in Wellington who allocate our national taxpayers' monies have actually allocated some in this direction.

But I will go back to the word Devolution. Devolution does not mean abdication; it does not in any sense mean abdication. It means that there is a wish always that local issues are given leadership by local people and that local people come up with solutions which are satisfactory to them, and then involve Central Government as partners in it. Now I think that is where we

are here. There is no indication that Central Government will say, “we’re going to put a pile of money aside and we will give it to the people of Lake Brunner or Rotoiti and say go and fix it”. Again, it does not work that way. But as the previous two speakers have said, there is a huge involvement that goes beyond a dollar cost about involvement of the community, satisfaction with the solutions, direction, all those sorts of things, things that you guys are doing now. That's happening, I mean this is a beyond dollar value contribution.

I do not get any impression at all from Central Government that they are anything other than happy with the level of interaction and involvement, the searching for solutions that is occurring now. But we still stop short from saying; this is how much the steps are. Now the only specific let's do something about it has been the Ohau Channel and the Channel proposal to Government was met on the basis of “yes we will have a 50/50 involvement”, which to my memory was \$4 million from Central Government; they said yes we will go with the 50/50. It is now \$15 million and I understand it is growing, but that is still not expensive compared with what other systems that I have been involved with around the world have cost to fix. But it still means that if it's \$15 million, you need to go back to Central Government and say, hey what formula are we going to use? I am not at all pessimistic about the opportunity for Local and Central Government to work out a system when the leadership for what the solution is comes from the local area.

*Simon Moore, Auckland* – One of the issues which certainly I would like to get an answer on is, we are invited to go to Central Government when we have matters in hand and when there are matters that we can put to Central Government, so that Central Government can look at questions of funding. But what are the issues in your view which are going to be most influential to Central Government in terms of that exercise? In other words, what are the sorts of things that we need to say to Central Government which are going to provide the most effective, persuasive catalysts for change and for funding from that source? Thank you.

*Barry Carbon:* That is a very, very good question and somebody introduced me as only having eight days to go but I will stick my neck out still. I think there are three things you need to do:

- 1) I think you need to have a solution or even better still a family of solutions which will wash in the local community. You can not go back down to Central Government and say we have got this great idea and if you give us the money, you could push it through the local people, they will hate you forever but it will fix the problem.
- 2) You have to look at a system whereby Central Government can say to the rest of the taxpayers in the country, they are pulling their weight down there. Now Environment Bay of Plenty has got assets coming out of its ears, it is looked upon in Wellington as being a very rich Regional Government – that is real, it does not matter whether you believe it or not – and so an approach that says, “hey we would like you Central Government to do this and we’re not going to do something about it ourselves”, is not going to wash pretty well when Central Government is asking the same questions about say, West Coast Regional Council and they have got some water management issues over there too.

- 3) You have got to give them some notice. You know as well as I do that you go through economic peak and troughs; right now I think the Government is confident about allocating its budget for next year, but predicting years two, three, and four is going to be really hard. I could not imagine that any Government would want in the next six months to make a medium-term commitment until it finds out what the shape of the economy is going to be in two or three months.

So three simple terms.

*Bryan Riesterer, EBOP:* Barry, we are not rich, we do not have this wonderful cash flow system that can buy the world, and I think that you will find when you hear John Cronin's message coming up; you will see that we have already doubled the amount of money the Government have put up into this Rotorua area. We have already put our finger out and clearly, we are only rich because we never sold it like everybody else did; so are we wrong for doing that? And then why should that all go in one place?

*Barry Carbon:* I think it would be less than honest of me to give you a message that was not the perception; the perception in Wellington is that this is a rich Regional Council and is an asset-rich Council. Now whether that is true or not, I am not going to enter that, but I was asked the question about how do you get there, and that is the perception there.

Can I tell my story? *Go for it, yeah.*

Every now and again in my job, and I have had a great series of jobs, I get up myself and think Jeez this is going well. I got a come-uppance this week that I want to share with you because it is about lakes. I was telephoned and the person missed me but he left messages a couple of time, from the Los Angeles Times. The Los Angeles Times is writing a story about blue-green algae around the world. The message that I got was, they had chased up and found this ex-Australian guy who has been involved in lakes, fixed up *Nodularia* in the Pearl Inlet and worked on *Lyngbya* in Moreton Bay and copper pollution in Mount Lyall in Tasmania, and cleaned up the air and pollution; and they wanted to talk to him about a feature article they were writing and would Barry talk to them. Well when I got the message, my head swelled up so much I could hardly get through the doors at work you know.

I spoke to the reporter yesterday and he said, "I'm checking some facts." And I said "yeah", and I'd actually gone back and studied it all up so I could give him all this knowledge about stuff, and he said "were you the guy in Queensland looking at *Lyngbya* (the other name for *Lyngbya* is *Fireweed* and when it dries out it really burns, it stings) –were you the guy in Queensland that in a symposium held up some stuff to some people and said "don't touch this because it burns?" Yes I said. He said "Did you accidentally touch it and then sting your lips?" Yes I said and I thought I wonder where this is going, and he said "And then did someone from the audience yell out don't go for a pee because you'll take the skin off it?" I said yes. He said "thank you very much, that's the bit I wanted to write."

# What Ways Can the Costs of Restoration be Shared?

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## ABSTRACT

This presentation draws on work undertaken for Environment Bay of Plenty in the early part of 2004. The brief for that work was twofold; to provide EBOP with a consistent framework within which to consider the optimal means allocating current and future cost of restoring water quality and to provide EBOP with background analysis to assist it in making a case for a contribution from central government funds.

The presentation will provide an overview of the findings of the report for EBOP. It will consider particularly:

- Polluter pays versus beneficiary pays including international views on the place of environmental regulation and options for allocating costs through regulation.
- The history of agricultural development in the Rotorua district.
- Unbundling beneficiary pays -- is it user pays for private benefits, or is it payment for public goods -- and are these local regional or national.
- Treaty issues.

The presentation will finish with the conclusions presented to EBOP.

## TRANSCRIPT

Essentially what I am going to do is give you a brief overview of work which we did for Environment Bay of Plenty a couple of years ago to help them in developing their case to Central Government to share funding. What I am going to cover and some of this you will have heard in varying forms already this morning, are these 5:

- Polluter Pays versus Beneficiary Pays
- a bit of background which most of you already know of what happened to develop the Rotorua District
- a look at some international views
- trying to unbundle beneficiary pays which is an interesting exercise
- conclusions we presented to Environment Bay of Plenty, which did not amount to a set of recommendations so much as things to think about as you develop your case to Central Government and others

As other speakers have pointed out, when you are looking at how you fund the cost of environmental remediation, you are essentially looking at the least distortionary means, including minimising the risk of further degradation. The Polluter Pays principle, and Dan has stressed this, is really focused on trying to influence future conduct; so you are requiring someone to carry the full cost of what they are doing. You hopefully get them to reflect that in terms of the activities they undertake. If the activities have already taken place, then obviously you cannot influence the form of that activity, so generally there is a sense that the polluter pays principle is not of a great deal of use where you are dealing with damage that has already been done.

In contrast, the Beneficiary Pays principle is a focus on who benefits and on the mechanisms that enable beneficiaries to 'purchase' desired outcomes. From a Government perspective there is a fundamental difference between the two and it is worth keeping in mind. Polluter pays generally looks at regulatory means of imposing particular costs on particular people that equate to the cost of the environmental damage involved. When you are looking at Beneficiary Pays, if it is a private benefit people can contract for it as, say, orchardists do with beekeepers in order to get their orchards pollinated. The Government does not have to be involved.

When they are public goods, and you are talking about benefits that are broadly diffuse and a Government central or local is paying on behalf of beneficiaries, the problem is the Government does not have a revenue flow directly associated with it. It is looking at allocating funds from general taxation or from rates and often with taxpayers or ratepayers saying, "we're not so sure about that - we like clean lakes but we don't like high taxes". So there is a bit of an asymmetry between those two that in pure policy terms needs to be kept in mind.

So to some specific issues: regulating to restrict future conduct is a common activity of Government. In other words, talking about "okay it used to be alright to do this but we're now changing the rules" is pretty common. We see it in every facet of our lives, Governments do intervene and I will talk about that a little shortly.

The second issue we have heard about is non-point source or diffuse pollution as compared with point source pollution. The question of retro-activity and there are some international views around that, do you actually get at people for things that have happened in the past? A general principle which you have already heard is that, ideally, you want to allocate costs so as to maximise economic efficiency. It makes sense, resources are limited so let's do things that make sure we get the best use out of them. I will say a bit more about the retro-activity one, there has been quite a lot of debate internationally, Europe and Australia in particular, around the issue of what do you do with the costs of past pollution. In a general sense, particularly with non-point pollution, it does not make a lot of sense in equity to do anything else. To actually go back and try and charge people for that, that seems to be coming unacceptable. It is partly pragmatic because there are political issues around this as well, but a general sense that the issue of past pollution is something that the community needs to pick up in some form in the present environment rather than simply saying, whoever happens to be sitting on that chair when the music stops, is the person who pays.

## The Role of Government

- Substantial encouragement of agricultural production.
- Cheap finance through the State Advances Corporation. Fertiliser subsidies. The nil standard value system.
- The Livestock Incentive Scheme and the Land Development Encouragement Loan Scheme.
- Supplementary Minimum Prices

This is probably well-known history, but it is quite important in terms of thinking about who were the contributors. The history of the Rotorua district had some rapid agricultural development post Second World War, driven by Government and Lands & Survey and Board of Maori Affairs. More generally, Governments encouraged agricultural production. Cheap finance, subsidies of all sorts, strengths and sizes; so weird and wonderful in terms of 2006 thinking, rather dreadful things were done in the main trying to increase agricultural production. Then a change of heart that we all recognised. This slide is a quotation from a MAF publication recognising that in terms of economic efficiency and for that matter, environmental damage, a lot of the things which Government might explicitly encourage people to do, were not terribly sensible and have resulted in costs that we are still carrying. In terms of Rotorua though, it is not just agricultural production.

If you go to Taupo, basically as I understand it, there is a general sense that the main issue that lake is faced with is non-point diffuse pollution from agricultural sources. Rotorua has a bunch of different contributors, partly from agriculture, partly from the habit of discharging sewage into the lake, and storm water may have had something to do with it as well, and partly natural point sources such as Tikitere and the Hamurana Springs. One thing that does in terms of thinking about how you get the public's support for what needs to be done, is it becomes easier for people to say, "Well actually it's not us, it's that thing over there". This is quite an important issue to think about because, as Barry Carbon emphasised, if you want to talk seriously to Government about these issues, you do need some form of community consensus about what you are dealing with and how you are going to deal with it; and your complexity actually makes that much more difficult.

Who pays? Retro-activity is a difficult one. Generally the literature on policy developments internationally is saying for retro-active diffuse pollution, the question of who pays is a combination of political expediency – what you can actually get through and get the voters to accept; fairness and equity and the past role of Government in encouraging particular activities is clearly part of that. I will talk a little later about why I think the Government finds it hard to accept that is better than the user pays principle – in other words, past pollution, past activity. We can not really use the polluter pays approach in terms of getting effective agreed community support of outcomes.

On the other hand, there is a clear case for imposing liability on future activity; but the interesting question in respect of pastoral agriculture is if you impose, as Environment Bay of Plenty have done, a rule which in effect caps nutrient export, is that solely restricting future activity or is it partly a penalty on past activity? The farmer who has purchased the farm in the expectation that it will be possible to increase production, is told, “well you might be able to but your nutrient export is going to be fixed at this level so unless you can find a way of dealing with that, sorry you can’t do this” ... are you in fact in essence penalising that farmer or at least imposing a cost on him, irrespective of past activity?

It is a very interesting debate. Probably more important is the question that Dan Marsh wanted to dodge, what about people whose properties are in one sense or another under-developed or could be converted to a higher use. It is an issue for Tuwharetoa where their forest lands are on Taupo, it is an issue for Te Arawa with the number of Maori Land Trusts around the lakes where the land is not yet developed. I have heard suggestions that some Tangata Whenua may see the imposition of a cap on nutrient exports, therefore, effectively saying this land remains undeveloped or for forestry use, unless you can get into permit trading, as a second taking without compensation. That is another little issue that goes into the mix of working out who carries what cost.

Now to the issue around Beneficiary Pays and trying to do some unbundling around this. If you think about the benefits of remediating what has happened to the Rotorua lakes, there are obviously a number of different sorts of benefits and different beneficiaries. Economic benefits to commercial interests who use the lake. Interestingly, I found in doing this work, talking to people in the tourism sector in Rotorua, that the general sense was that the lakes were not an important part of the Rotorua tourist product. Why? What I was told was that most of the tourists that come here are package tourists, they come for a dash of Maori culture and a sniff of geo-thermal activity and on they go; and very few of them have much to do with the lakes. That may be an accurate description of the Rotorua tourism industry in terms of implications for tourism, it may not. New Zealand’s reputation in terms of clean, green image and Rotorua is a great place to come to, will not be benefited if we have a couple of cesspools sitting in the middle of it.

The second set of benefits: -

- Aesthetic Benefits to Residents and Business - a clean, pure lake is a great experience and it has a lot of value for people.
- Usage Benefits to Individuals, people who actually use the lakes for recreational purposes.
- Cultural and Spiritual Benefits, most particularly for Maori but I think for anyone.
- Reputational Benefits for us if we get it right or wrong
- What economists term Option Benefits – people are quite often willing to pay for something that they may never use and may never see, just for the knowledge that it is there, so that there is in a sense a value attached.

Someone who lives in the South Island might never come north, but has a sense of “yes – we got that right, and I am prepared ... and the opportunity I might have to visit or use those lakes - it is worth paying for, even though I might never use them”. What that also emphasises though is that you are looking at a whole series of micro-issues around who should pay, and I will come back again to that.



Some of the preliminary factors to look at are the complexity of the Rotorua situation, in the sense of multi-causality, and that the research is still ongoing in terms of what exactly wants doing, and what the best means of addressing it are. So there is uncertainty as well, there are short-term and long-term issues associated with that as you all know.

What I am going to refer to is the Lake Taupo Precedent, and rest on that word ‘precedent’ for a little while. If you talk to the Ministry for the Environment and we listened to Barry this morning, they are basically saying Lake Taupo is not a precedent. Why? My assessment, which Government officials may not necessarily agree with, is that in the current Government and indeed in any Government in New Zealand in current conditions, one of the things you are very concerned about is managing fiscal risk. We have had a lot of publicity in recent times about the size of the Government's surplus and money falling off trees all over the place; my view is substantially different – the Government's fiscal position in the medium-term is highly risky, if I can put it that way, with the fact that pressures on Government expenditure are significantly greater than the likely revenue flows. Then there are our Australian friends – they benefit from the tax cuts of course which the Liberals are thinking of shortly, that is going to further put pressure on the New Zealand Government.

One of the very strong incentives in Central Government is to push away the idea that anything is a precedent, for fear that would simply increase future liability. It is not just in issues such as remediation of the lakes, there are a whole set of areas where New Zealanders have done things in a rather carefree way without thinking of the consequences, all with the belief that the taxpayer will pick up the bill. One can look at, for example, what has happened in the Manawatu and Bay of Plenty floods and then at what happened with the Gisborne flood which was rather different. What you have got is an emerging view within Government that the taxpayer can no longer be the implicit underwriter of those sorts of activities. The whole business of “we don’t want precedents” has got some very, very strong drivers about affordability.

But I am still going to use the term “the lake Taupo precedent”, if only because in talking with Government about funding remediation, what it did in a previous similar case has clearly got some relevance. Here, multi-causality, the fact that some work would precede regardless of the state of the lakes; the work that Rotorua District Council is now doing in terms of further sewerage works, would happen anywhere in the country and regardless of the quality of the water, because it is now accepted that you just do not do that kind of thing, you keep sewage out of natural waters if you can.

We have got the issue of short-term versus the long-term, the Ohau Channel diversion – fine, but what if you are going into a long-term flocculation programme? Can you be sure of how that will work, what it will cost and what the benefits will be? There is a strong need for research and the other side of that coin, a relatively high level of uncertainty about exactly what you will be doing, at what cost and to what effect. The probability of the proposed measures being effective is fairly significant when you are talking to people about paying for them, because clearly that affects their judgement and valuation of benefits. A number of criteria in the Taupo case were set out in a Cabinet paper, and they are the kinds of things that would need to be talked about in dealing with any similar situation.

“Nationally important status”, there is no particular definition of that. It is more a matter of how people believe that the lakes themselves are perceived by the average Joe around the country. Do people think they matter, are they important? The answer in respect of Taupo has been yes; likewise as Barry acknowledges and most others would too, in respect of the Rotorua lakes it is hard to argue that they are insignificant.

The cost burden on ratepayers was a very significant issue in the Taupo situation. Initially the agreement between the three parties was that each would pay a third of the costs. Taupo then went back to Government and said “we’ve done our sums, we’ve looked at the cost, we cannot afford to go to a third”. It was renegotiated, and from memory, Taupo District is now paying 20% and the Government is now paying 45% rather than 33%; and the message that this has given Government is the fiscal risk around this stuff. You end up with an agreement and think you have limited your liability and hey presto, suddenly it is another third higher; and that will happen.

Past national and local policies relating to catchment development. It is very, very clear that Government was up to its eyeballs encouraging development around the lakes here and must accept that there is some kind of collective responsibility for the consequences. In Taupo, Crown landholdings were an issue, Land Corp is a major landowner around the lake and that was seen I think as partly that the Government had another instrumentality that it could use through the way Land Corp managed its farms, in order to mitigate discharge.

The treaty relationship was seen as important; the same thing is an issue here. You will be aware of the settlement transferring the bed of the lakes. Then the last thing called Relevant National Policies – I can never really track that one down when discussing it with officials, except it seemed to mean anything else we can think of that makes sense. In a way I am not too uncomfortable about that, because that is really recognising you are looking at these situations on a case by case basis. We are thinking of what really matters here and what are the impacts, and what is our current state of knowledge.

## Ability to Pay

- A crucial issue in the Taupo situation – Taupo District unable to meet one third – government’s share increased to 45% from 33%.
- Comparison of Taupo (with 36% in deciles one and two) with either Rotorua or Bay of Plenty generally shows similar or worse levels of deprivation.
- Taupo District’s “public wealth” broadly equivalent to EBOP’s.

Ability to pay – it was a crucial issue in Taupo. If you compare the two communities, Taupo with Rotorua, and the issue in Taupo was 36% of our population are in the lowest two deciles in income terms, but then look at some other things. Taupo’s public wealth is per capita broadly equivalent to EBOP’s because they sold an electricity undertaking and put the money in the bank.

But look at deprivation in the Bay of Plenty and this is the counter to the argument that EBOP is a wealthy Regional Council. I have heard that argument several times and I think frankly the way it is presented reflects a level of lack of understanding. But that is partly, I believe, Environment Bay of Plenty’s own issue in terms of how it communicates and I do not think

EBOP has communicated well the realities. If EBOP uses its wealth to fund remediation, by definition it can not use it for other purposes within the region. It can not use it for example to address social deprivation. Within the Eastern Bay we have some of the most deprived communities in all of New Zealand.

Rotorua is basically where Taupo is, but look at Kawerau, Whakatane and Opotiki and think of them in terms of poverty. If you move to the Western Bay, average hourly earnings for males in Tauranga are 86% of the New Zealand average. In the Western Bay neither the male nor the female average weekly wage rate is above 80% of the national average. So you are talking about a region as a whole which is relatively poor and significantly deprived and to say that we have a wealthy Regional Council who should therefore be able to throw money around, is to completely ignore the realities of the regional situation and the obligations that

Council has in terms of community wellbeing. I think it is time that Central Government actually realised that when it runs that argument out, it is demonstrating the extraordinary distance not just in kilometres, but in perception between Wellington and the region.

Some issues around which beneficiaries and how to allocate costs. In terms of Beneficiary Pays, essentially you are talking about these as partly or totally public goods. There is an issue around whether they are local in the district, regional or national. I argue that there is a strong argument that the Lakes are seen as national public goods, partly because of the extraordinary transaction costs in allocating such things to individual groups of beneficiaries and then collecting. Would you double, for example, the licence fee for fisherman and carry the cost of collection associated with that? There is evidence that if you try and micro-manage beneficiary pays, the collection costs almost outweigh the amount you collect. Taxation in many respects is a superior means of recovery.

There are a series of conclusions which I strongly recommend you read through. They support taking the beneficiary pays approach. What has been happening internationally also supports the beneficiary pays approach. If you go back to the European example, consumers effectively pay the cost of putting costs on farmers because of the way their protection systems and their subsidy systems work. The broad equivalent in New Zealand of people who benefit from agricultural production are taxpayers. This country has essentially been built on the back of the agricultural sector, so it is hard to say the country should walk away from remediating some of the adverse impacts of agriculture.

I will leave you to read the rest of my paper but I will emphasise the last point about high levels of deprivation within the region, especially the Eastern Bay. This suggests that the idea of ratepayers effectively paying, because that is what the argument about EBOP paying collapses down to, is not, in terms of our social values, a particularly brilliant argument.

Deprivation in Bay of Plenty		
District	%age in Bottom 2 Deciles	%age in Bottom Decile
Rotorua	34%	18%
Kawerau	71%	46%
Whakatane	43%	25%
Opotiki	66%	59%



## Our Conclusions(1)

- Costs of remediation should be allocated on the basis of the beneficiary pays principle not the polluter pays principle.
- Applying the polluter pays principle would offend both against the general legal principle that people should not be held accountable for the costs of action which was lawful, and indeed encouraged by government, at the time it took place and against considerations of fairness and equity.
- It is accepted practice that environmental regulation, imposing restrictions on property rights, may be put in place without compensation to the extent that it affects future activity.

## Our Conclusions (2)

- European and Australian policy leans in favour of the view that environmental regulation that would require substantial, and wealth reducing, changes in accepted farming practices, without providing compensation, is essentially retroactive, even though it appears to be affecting future conduct. The reasoning is that farmers are, in a sense, hostage to existing practices as their investments were based on the ability to continue then industry accepted practice.
- The beneficiary pays principle should be applied on the basis that the benefits are essentially public goods, rather than an aggregation of separate private goods. The reasons for this include technical and other difficulties in breaking down and assigning benefits to different groups in a way that enables accurate quantification of those benefits.

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## Our Conclusions (3)

- Generally, the international view is that the appropriate beneficiary group, to meet the costs of remediation, is the taxpayer for reasons including the taxpayer's superior ability, as compared with any other group, to manage risk, the relatively low transaction costs of using taxation, and the relative absence of economic disincentives as compared with other instruments.
- There is an alternative for capturing the cost of environmental remediation as a consequence of agricultural activity. This is recovering the costs from consumers generally through a levy on agricultural products on the grounds that, collectively, they benefit from agricultural production and should therefore meet through the price they pay the full costs of that production. That approach can be applied in Europe where a significant part of agricultural production goes to domestic consumers. It could not be applied in New Zealand, as we have no instruments available which would allow us to recover additional costs, over and above the market price of commodities, from overseas consumers.

## Our Conclusions (4)

- By analogy from the European approach of holding consumers responsible, it is New Zealand taxpayers who should meet the cost of remediation. The basic reason is that they are the group within the reach of New Zealand regulatory and taxing powers who have drawn general benefits from agricultural production as the growth and prosperity of the New Zealand economy has been largely dependent on it.
- Despite the arguments that the taxpayer is the most appropriate funder of environmental remediation, it is clear that, in a New Zealand context, both regional councils and district councils will also be expected to make significant contributions.

## Our Conclusions (5)

- In the case of the district council this is a matter of endeavouring to estimate what are district level benefits as compared with regional or national benefits but offsetting that against ability to pay and the relative inefficiency of using rates as compared with taxes.
- At the regional level it is difficult to see how regional ratepayers, generally, would benefit in ways that are significantly different from the ways that New Zealanders generally would benefit. However, the Regional Council's environmental management role clearly provides an argument that its contribution should be significant.

## Our Conclusions (6)

- Offsetting this, it is clear that the practical reality is that any regional council contribution will be funded directly by ratepayers – the argument that EBOP can afford to contribute from the regional wealth it holds on analysis becomes an argument that ratepayers should contribute as rates increases would be needed to substitute for any payment from the region's wealth.
- High levels of deprivation, especially in the Eastern Bay, suggest that the ability of the region's ratepayers to contribute is significantly less than that of (say) regional ratepayers in the Waikato region in relation to Lake Taupo.

## QUESTIONS

*John Green – LWQS:* Peter, thank you very much for your address, it was excellent. It seems to us from what Barry Carbon said in the previous presentation that EBOP suffers from a perception problem down in Central Government. Could you perhaps expand a little bit on how do you think Environment Bay of Plenty could redress this situation please?

*Peter McKinlay:* Environment Bay of Plenty I think has historically been quite concerned about the interest that other parties might have in its poutea and understandably so. The argument that I put forward is one that I am not sure the Regional Council would necessarily embrace, because it has its own implications in terms of the Regional Council taking a higher profile in terms of community wellbeing in areas such as the social and economic side of life; and that is an issue which I think they have yet to address. But it is part of the cost I think of them taking the case to Central Government that although they appear wealthy, they are a Regional Council in a relatively poor region and that the first and obvious claim on that wealth is the region.

A second supporting factor though around issues of this sort is that there is a measure of community consensus when you go to Government to talk about these issues, and one of the things that I think is still yet to be solved in the Rotorua lakes issue is how you build community consensus. There are clearly significant sectors within the Rotorua District who believe that what has been put forward about remediating lakes is almost an attack on those sectors, and they need to be brought into the tent. As any marketer will tell you - to go to someone and tell them they ought to buy your product because it is a moral obligation, does not actually get you a sale. It is a question of how do you build that community consensus. So that when EBOP is talking to Central Government, it is talking from a platform of understanding both about the nature of its wealth and the competing claims that might be made on that, and it's talking in terms of a community consensus about why it's talking to Government and why the district thinks the Government should be part.

*Lindsay Brighthouse, Rotoiti:* I have been a resident of Lake Rotoiti now for nearly twenty years and on hearing your discussion there, I think possibly we are coming around to a realisation that the Rotorua lakes are a national asset. There are a couple of interesting figures here that have come up over the years since I have been here. Just regarding the usage of the lakes, in a ratepayer survey about four or five years ago we actually found that 80% of the boats on Lake Rotoiti at any one time come from out of Rotorua and 20% were actually local people.

The other point that mystifies us rather is all the scientific testing that has been done recently shows that only 5% of the nutrient contribution to the lakes comes from lakeside septic tanks – an amazingly small figure. What is concerning us I think is that we are being faced with a cost of possibly \$20,000 per household to have sewerage systems put in. It is a huge amount and what we are talking about here in contributions is becoming more important all the time, because many people just simply will not be able to afford that and they will have to shift.

The biggest worry really as far as Rotorua goes is we have only got a growth rate of 1.5% a year, so we just simply do not have the bases of ratepayers to pay for these huge costs that are coming up. There is no question in our minds and I think I speak for most of the residents

that our local authorities have actually been in denial of the lakes up until about five years ago. Huge opportunities were lost twenty years ago because the sewerage schemes which we are facing now were not put in then when they would have cost about 1/10<sup>th</sup> of the price. I think my question is, from your talk you seem to be alluding that the cost that we are faced with these lakes being repaired is more of a national problem than just directly a Rotorua problem?

*Peter McKinlay:* I think it is a mix. If you take the sewerage issue, it would now be generally accepted that any means of disposing of sewage which resulted in seepage to a lake is no longer acceptable practice. I think that the issue of moving from on site to a consolidated system would arise regardless of the state of the lakes. I think that is a totally separate issue, although it is very obviously bound up with the question of quality of the lakes. You are actually looking at a situation where some of the sewage related pollution will come from the district, partly because of the past practice of discharging into Lake Rotorua. In terms of the burden that all local authorities across the country are now facing to bring infrastructure provision up to what is seen as currently acceptable environmental standards; that means that with sewage you do not have discharges into the lakes, directly or indirectly.

The financing side is a totally separate one, there are ways of addressing those sorts of issues but this is not really what I wish to go into. And finally on your boats one, yes I think you are right. Most of the boats do come from outside but that does not necessarily mean that you have somehow got an external pool of people that you can tap to fund remediation. It does go to the case that these lakes are a national rather than a local asset.

# Lake Restoration – Cutting The Pie

John Cronin

*Chair, Environment Bay of Plenty*

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## TRANSCRIPT

Good morning everybody. By training I am an accountant, so probably I take a fairly pragmatic approach. We are an environmental Council which means we have to balance both the academic, the social, economic values, and environmental good – that is not measured in dollars, but somebody has got to write the cheque. So this address to you today is about cutting the pie because as an Accountant, as a Council, we bring it back to dollar terms somewhere along the line.

These lakes will not fix themselves; people's attitudes have to change. We know that, but right now quite a lot of dollars have to be spent. We will do our best in cooperation, taking into account all the opinions, but someone has to take the decision to encourage and lead, recognising that others are also giving leadership, such as Rick Vallance yesterday in his address. In our leadership with Rotorua District Council and Te Arawa, quite frankly – we are getting on.

### The Rotorua Lakes Strategy goals

- *Protection*
- *Use*
- *Enjoyment*
- *Management*

This is about local buy-in, as Barry Carbon earlier today challenged us, and I would say to you all, that is what we are doing. These goals are self-explanatory and take into account the whole of the catchment. Everyone has the same goals, but slightly different emphasis at times. We all want that protection, use, enjoyment and management, but we all have different value sets of how we measure them, but it is what we all want.

How is this being done? Local solutions by the local people – it is the local of Local Government, this is the administrative group, it is part of the lakes settlement between Te Arawa and the Crown, and it was passed into legislation. It is standing the test of time and doing the coordination, the research, the works, the funding; it is actually doing the high end governance. It is not management or work on the ground, but putting into account the political inputs at a local level; and we are well supported in this with representation from Central Government, who attend all of those meetings.

## The overall cost

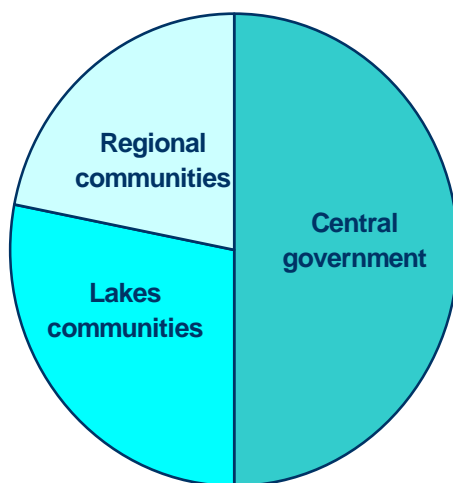
Paul Dell in his address yesterday showed you this same chart (*Dell, Figure 9*). Our EBOP's pie is on the left-hand side and it is not inconsiderable. We have our funding lined up, but we must have, and do need to be in partnership with Government, so you can see that \$90 million and how it is split with Government and Ministry for the Environment (MfE) over time. I will address that a little bit later. Rick Vallance yesterday put it right – he said “we’re all in this together” and we are - EBOP and the Government on the left-hand side, RDC and the Government on the right-hand side and all paddling the same canoe.

**Who pays?** That makes a little bit of difference to us, doesn't it? I have listened to the innovation, the creation of wealth, but not about writing the cheques. I have heard all the economics and economic values and the values of the lakes; but these lakes, as I said earlier in the address, you are only going to fix them by putting money at it over time, but that money has to be backed by very sound science.

In the pie (*Figure 1*) note that there are only three contributors. But the regional ratepayers are in part the same ratepayers as the district ratepayers; so they are paying a huge share of looking after these lakes. If they are iconic and these lakes are supporting tourism, the tourism industry is notable by its absence as a funding partner, and probably notable by its absence in this room. I would say to you, is it really fair that the property owners are tackling the full burden? But that is all we can do under the current legislation.

*Figure 1.*

WHO  
PAYS?



## The cost for Environment Bay of Plenty

- \$16.5 million over 10 years – technical investigation and coordination
- \$45 million over 10 years – capital works/actions

These are our costs and they are not insignificant. In the funding model (Dell, figure 9) you saw the \$45 million from us, \$45 from Central Government, and we still need some confirmation of that; but from Environment Bay of Plenty, ourselves, we are also funding from our own resources, or from your resources, which they really are, they all belong to the community, then a further \$16.5 million on ongoing research.



This takes us to the monitoring and our normal work, apart from the fact that we also do environmental farm plans within the catchment, sewerage subsidies, etc. While we suggest we need from Government \$45 million, it is not \$45 million that we are asking the Government to front up at all. Rising to Barry Carbon's remarks – it is asking Government to commit to working with us on an adaptive management programme. That is what we want, the commitments of Government to an adaptive management programme where we all really have a high end idea of the numbers, so we can plan adequately and work together in partnership.

### **The goals**

*By 2016:*

- *Improved water quality*
- *Action plans working*
- *Land use from high to lower nutrient production*

These are pretty self-explanatory; everyone wants improved water quality and all the action plans working, land use from high to lower nutrient production, while again, referring back to Rick Vallance's speech, achieving a higher economic return. So science has to work together to do just that.

### **Rating sub-committee**

- *Review of “fairness and equity”*
- *Beneficiaries and exacerbators*
- *Regional contribution \$15→\$20*
- *Consultation > 900 responses on targeted rates*

Over the past year there has been a rating sub-committee which has met a number of times and had pretty robust discussion. We realised very early in the piece that the lakes community needed help from the wider region, that it could not do it on its own and at the present time we were looking at a regional contribution of approximately \$20 per rateable property, or \$2.28 million to come in from that, and over the region there are about 114,000 rateable properties. We recognise that. In consultation with the public we had nine hundred responses mainly supportive of moving towards this targeted rating programme.

### **Rotorua Lakes Protection and Restoration Action Programme rate**

- *Targeted rate funds 56% of operating expenditure*
- *Rise in targeted rate over 3 years to \$2.8 million by year 3*
- *46% from general funds*

I know that Dr Pam Kaval, and then Nimmo Bell, noted from the report, the willingness of people to pay some \$91.24 per rateable taxpayer, but quite frankly we do not intend to propose that at all. Our annual spend is approximately \$5 million based on Government contributing its 50% of the action costs. If we can not engage satisfactorily with Government, there will be trouble on the near horizon. The previous speaker, Peter McKinlay, highlighted the reason why in his view Central Government should contribute. If the Government does

not, and does not regard these lakes as nationally important, I would have to say are they regionally important? They might be of extreme value to Rotorua but are they regionally important? If Central Government says they are not going to contribute - I do not for a moment think that is the case, but I am saying there is a need to determine the iconic nature of these lakes and their regional importance.

### **Targeted rate detail**

*By 2006/2007:*

- *\$62 for urban properties*
- *\$100 for rural properties*

*By 2008/2009:*

- *\$80 for residential and commercial properties < 4 ha*
- *\$1.24 per ha for low nutrient discharge properties*
- *\$10.58 per ha for moderate discharge properties*
- *\$53.72 per ha for high nutrient discharge properties*

These are our **draft** funding proposals; they will be going out for comments for 2006/7. We are proposing that there will be an additional targeted rate of \$62 for the urban ratepayers and \$100 for the rural ratepayers. We have a more complicated position from 2008/9 where we are considering the exacerbator pays, but we need to get that machinery right. Until we actually have a proper handle on that, we will use the range of \$62 and \$100. However if the Government said “Hey guys, you’re on your own, Regional Council, RDC you’ve got to do it all”, basically the rates would double. In the example of high nutrient discharge properties, a 200 hectare dairy farm would need to pay an additional rating burden of some \$10,000 and that is not just rates. So it is considerable.

### **The 10 year plan**

Further consultation on:

- *Lakes actions*
- *Lakes expenditure*
- *Targeted rate*

We are currently completing our ten year plan, shortly to be released. The document is to go for public consultation. It is our view of what we think the public expect of us. We are trying very hard not to put it out and say “this is what we’re doing guys, like it or lump it”. It is a two-way street and that is our view - what we think the public wants of us from the consultation we have had; our preliminary views on targeting rates and the replies back. We do need your views. It is not acceptable to take a “do nothing” option. It is also not acceptable just to say “That guy’s got to pay, anybody else but me”. So we have got to work closely together.

In closing, that is how we see the cutting of the cake; it is not extravagant, we believe it is realistic, achievable and most importantly, we think it is affordable within our communities. I stress very strongly, we do need to engage Government to work with us over the next ten year period in an adaptive management situation. We, because of legislation, have to put our plans up for ten years and we have to do it for ten years now. It makes it difficult for us when Central Government itself does not plan that far ahead, so there are machinery difficulties of how to engage Government into an adaptive programme when their funding lines are much shorter in period, but we need to work with them.

**Together, all of us, the Councils, the Government, the community – we can make it happen and it is a case of local solutions to the local problems. Thank you.**

## QUESTIONS

*Dan Marsh, University of Waikato:* With regard to the targeted rates, as I understand it that would be paid simply as if you are a dairy farmer, you would pay \$50 per hectare. Have you considered a more flexible approach whereby the payment would be based on actual discharges, for example, through modelling nutrient exports, given that that sort of system would give a dairy farmer an incentive to try and reduce their export? Just paying a fixed rate, because you are a dairy farmer, does not give that incentive.

*John Cronin:* I do not think we have considered that. We are open to discussions and that will come out, but we have not discussed that one in any depth at the moment. We did note that there is some record-keeping and need for measurement of nutrient discharges in the lakes areas and until that science is right, we would stick to the more generic of the \$62 and \$100.

*John Green – LWQS:* Barry Carbon mentioned how important was the approach to Central Government and having them buy into the problem that we all have; in other words we are all buying in. Could you please tell us who the representatives are from Environment Bay of Plenty who spend time with the Government agents? Are they the elected representatives or are they the management of Environment Bay of Plenty?

*John Cronin:* We deal basically with the Government through the Lakes Management Strategy Brief which is the Environment Bay of Plenty with two representatives which are myself and Councillor Cleghorn; two from Te Arawa and two from Rotorua District Council, who are the Mayor and Councillor Sturt, and Paul Dell is our linkage with the Government. The Government has Tim Bennetts down here attending all of those meetings and there is constant liaison.

*Margaret Murray-Benge, Western Bay of Plenty:* I am one of those poor people from the Western Bay of Plenty. Mr McKinlay I thought your speech was brilliant. Mr Cronin, I will not have the opportunity to say this anywhere else, so forgive me, Mr Chairman, but I think it needs to be said. The Regional Council is a privileged Council because at the time of amalgamation you got the dividends from the Harbour Board. How you invested those was over to your good management but you have done so, so you have offended the people in Tauranga successfully by putting up this building in Sulphur Point which nobody wants and I look and say, as an Accountant could you not redirect the budget to make sure that you do not

start leaning too heavily on landowners. And Mr McKinlay, this is something I think that is relevant for you as in your area, I find it hard to see how Councils can be involved in long-term planning with a ten year horizon - good guesstimates I suppose. . I am here because of the Kaituna River and what happens goes into it, so you can shift the problem but it does not necessarily take it away. For the poor landowners, they are involved in the local authority that has to go into ten year planning, then the Government says we must audit it, and then it will charge the community for the privilege of auditing and it just seems as though Government gets right off the hook. But so too, Sir, do you, because I think in some of the management decisions that have been made by the Regional Council, a lot of people are not that satisfied. Sorry.

*John Cronin:* Well I will comment on just two minor points. Local Government reorganisation gave Western Bay Council approximately the same value dollars as the Regional Council got. What you did with it and how you spent it was up to you. But putting your rates into perspective, the average Regional Council ratepayer has been paying a rateable assessment of about \$80 per annum, not per week, per annum. It may go up to about \$100 in any developments that we may do, we do not expect a turn-back on the ratepayers, but that is really outside the focus of this meeting.

*Lindsay Brighouse, Lake Rotoiti:* John, in all of the cost-sharing that we have seen so far, there seems to be an element missing. It was alluded to very briefly yesterday and that was the impact of the corporates – by the corporates. I mean Carter Holt who forest the whole of the southern shore of Lake Rotoiti; Fonterra who basically control the dairy farms, and also the tourism industry - and there is no secret that most of the tourist industry in Rotorua is owned offshore. Now in all these co-sharing things, is there an element somewhere in there that the corporates could pay more for the privileges that they have of being here?

*John Cronin:* I think you are probably right but there is no legislative power of the Regional Council to deal with that.

# Wastewater Schemes Projects

Kevin Winters  
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## TRANSCRIPT

I come to you today with two hats on really; one as Mayor of Rotorua and the other as Chair of the Rotorua Lakes Joint Strategy Committee. Can I first say that I have got Nico Claassen here as well, because I know some of the questions at the end of the session will be of a technical nature. Nico is our District Engineer so I will probably get him up to answer those questions. Also Councillor Searancke is here from the Works Committee; the Works Committee is the one who is putting in all the sewerage schemes; and I also acknowledge my other fellow Councillors here this morning too, thank you for coming along.

A brief outline - I want to talk about the Rotorua Lakes Joint Strategy Committee. I want you to know that through Te Arawa and EBOP, we are singing off the same songsheet; there will be a bit of replication here this morning but I do not think that is an issue at all. Then we will look at the overall costs and I want to go into some detail about the rural lakeside sewerage community schemes. We will get into some urban sewerage schemes that we are trying to tackle, both the funding and an update on some of the wastewater treatment plant improvements that we are doing. There was a comment made - "we've sat on our hands until the last 5 years". That is an opinion but we have been doing a lot of work since 1984 to try and rectify this problem. Then we will get into some questions. Also, tena koe Anaru, kaumatua of Te Arawa Maori Trust Board – it is a pleasure to have you along here this morning Sir.

The Rotorua Lakes Joint Strategy Committee was a committee set up under statute, as part of the Deed of Settlement giving ownership of the lake beds back to Te Arawa. We are by statute responsible for the governance and management of the lakes. Paul Dell is our Project Manager. We are working very well together and we meet about five times per year. We have done presentations to Marion Hobbs when she was the Minister of Environment and a presentation to David Benson-Pope earlier this year.

This Strategy Committee has the task of the governance role. We have taken some of the science of the last fifty years and particularly the five years through Professor David Hamilton; we are putting a lot of those theories and quantities into projects and initiatives that we think are important over the next twenty years to clean up our lakes.

You have seen that slide many a time (Paul Dell, *Figure 9*, Preliminary split of costs). John Cronin spoke earlier this morning about the left-hand side. I want to go down the right-hand side. How is Rotorua District Council going to pay for all this? In terms of the cost programmes for RDC I will take my Chair of the Joint Strategy Committee hat off and put on my Mayoral hat now; so what I want to explain to you is how we are going to cost share that \$100 million for our portion of sewerage schemes.

## The Rural Lakeside Sewerage Community Schemes

We are providing sewerage reticulation over the next ten years to fourteen lakeside communities. It is going to improve the lake water quality and protection of public health. I am delighted that we have just finished our draft ten year plan discussions which took five days and there was no question of whether this \$100 million was in the draft 10 year plan. It is committed and that will be out next week for public consultation. This Council is absolutely committed to playing its role in fixing up our lakes and the commitment is there. It was not there five years ago because we tentatively put about a million dollars aside for cleaning up the lakes – that is now \$100 million – but we had done a lot of work in terms of the upgrading the existing sewerage plant.

*Figure 1. - RURAL LAKESIDE COMMUNITY SEWERAGE SCHEMES*

Community Scheme/Project	Proposed Completion Dates	Estimated Cost (\$m)	Project Status
Mourea / Okawa Bay (Duxton)	Completed	\$3.25	Connection of properties in April – May 2006
*Eastern Trunk Main	March 2006	\$6.50	Work almost complete
Brunswick / Rotokawa	Last quarter 2007	\$10.00	Detailed engineering design underway. Tendering of work programmed July 2006
Okareka / Blue Lake	Mid 2008	\$10.20	Detailed engineering design underway. Tendering of work programmed July 2006
Okere Falls Otaramarae Whangamarino	Last quarter 2008	\$14.40	-Preliminary design complete -Community consultation to proceed -Tendering of work programmed July 2006

*Figure 1.* goes into some detail. In Mourea/Okawa Bay we have completed the pipe work, the stuff in the ground – estimated cost \$2.35 million and we are going to be connecting those properties to the eastern trunk line in about April/May this year. That work is almost completed and I believe we are soon going to have a flush party to turn those pumps on. So we are getting some runs on the board.

Brunswick/Rotokawa, again that will be connected into the 12km eastern trunk line. Okareka and Blue Lake, we are doing detailed engineering design work now, tendering of the work in July. Okareka/Blue Lake and Tarawera, that is a huge commitment. We are not sure of the actual route of the pipeline yet but we are looking at bringing it back over the hill to Rotorua.

Okere Falls/Otaramarae and Whangamarino, again they will all be connected into the 12km pipeline to bring that sewerage back to our wastewater treatment plant.

Figure 2.

Community Scheme/Project	Proposed Completion Dates	Estimated Cost (\$m)	Project Status
Gisborne Point / Hinehopu	Mid 2009	\$9.70	Concept design completed
Hamurana	3 <sup>rd</sup> quarter 2011	\$13.45	Concept design completed
Tarawera	Late 2012	\$13.20	Concept design completed
Rotoma	Mid 2014	\$10.75	Concept design completed
	<u>TOTAL</u>	\$91.45	

\*Eastern Trunk Main cost shared between Mourea/Okawa Bay (Duxton)/Brunswick/Rotokawa

In Figure 2. Gisborne Point and Hinehopu, there is another big issue out at Rotoiti and you can see the costs there, similarly for Hamurana, Tarawera and Rotoma. \$92 million and unfortunately those are today's dollars. They are huge tasks ahead of us but the commitment is there as I said in our LTCCP. The eastern trunk line does allow for sub-division, further development on the eastern basin of our community, which is where we want to see development in the future which can hook up to the 12km pipeline.

### Urban Sewer Extensions

In terms of urban sewer extensions, Figure 3. there are a few pockets of communities – three areas that we have identified that we want to hook into our wastewater treatment plant. They will also help in lake water quality and protection.

Figure 3.- URBAN SEWER EXTENSIONS

Area	Proposed Completion Date	Estimated Cost (\$m)	Project Status
Hinemoa Point	Late 2007	1.65	Preliminary design complete Initial community consultation undertaken
Ngongotaha Highway	Late 2008	0.54	Concept design complete
Paradise Valley Road	Late 2009	0.32	Concept design complete
	<u>TOTAL</u>	2.51	

Hinemoa Point, we have had lots of submissions from this community that are still on septic tanks and we intend to get underway fairly soon in terms of community consultation. We have done quite a bit already but they are costings at this stage. Ngongataha Highway, again concept design completed; similarly with Paradise Valley – another \$2.5 million that we are looking into spending.

So if you look at that \$92 million and \$2.5 million, that is about \$95 million and round it up to \$100 million, so that is our commitment to sewerage schemes.

### Funding Sources

#### Ministry of Health (Sanitary Works Subsidy Scheme)

- *Qualification criteria includes protection of public health and socio-economic condition of community (Deprivation Index)*
- *Subsidy up to 50% of total cost for qualifying communities*
- *Subsidy for Mourea/Okawa Bay has final approval at 50%*
- *Provisional subsidy application for Brunswick/Rotokawa and Okareka/Blue Lake currently being considered*
- *Other schemes case by case basis*

This is the issue that is going to affect us all. So far, with Mourea/Okawa Bay we have had the final approval for the Ministry of Health subsidy at 50%. We have done provisional work for Brunswick, Rotokawa, and Okareka and Blue Lake and is currently under consideration. That is our dilemma because in our LTCCP we have said we need a 50% subsidy from Central Government to make all these schemes work. It really worries me when the Ministry of Health budget is set at about \$350 million for sewerage schemes throughout the country, and last year it was announced that that 50% subsidy could go to 90% based on socio-economic deprivation. There could be in our area of opportunity to increase that 50% slightly, but the 90% was really for the Auckland area. My concern, again like other speakers, is that we were asked to do these ten year plans; we are seeking a minimum 50% subsidy, it is only a \$350 million budget and if it runs out in five years time, what do we do as a community? That is our dilemma.

So the other schemes are considered on a case by case basis. There was another scheme announced recently too that the Ministry of Tourism was going to fund some of these schemes. However we found out we can not double-dip. The other funding partner is Environment Bay of Plenty and their qualification criteria includes socio-economic deprivation index. We have been given approval for Mourea and Rotokawa to come under the EBOP funding scheme. We are applying to EBOP for other schemes but we have got no guarantees whatsoever that we will qualify for that side of the equation.

### Rotorua District Council Ratepayers subsidy

- Current level at \$1,500 per Household Equivalent Unit (based on Mourea/Okawa Bay)



Currently the Rotorua District Council has decided that we are prepared to pay a subsidy to all those people who come on to the scheme of \$1,500 per household equivalent. As a collective body we have decided that the Rotorua District Council ratepayers believe it is very important for people to come on and we are prepared to pay \$1,500. To that end, you will see on your rates demand a lakes enhancement rate this year of about \$16 per property, and that money is going towards that \$1,500 per subsidy.

#### Indicative Contribution for property owners

- *Balance of cost (Excluding GST)*
- *Okawa Bay residents \$5,700.00 ( \$450.00 pa)*
- *Mourea residents \$3,700.00 (\$285.00 pa)*
- *Duxton hotel \$145,000.00 (\$13,000.00 pa)*
- *Cost of operating total wastewater treatment plant is set at a targeted rate of \$306.00 p.a. per household unit for 06/07 year*

The indicative costs for property owners - that is the balance of the cost for these schemes. For Okawa Bay residents it is about \$5,700 – that is the one-off capital cost. The other \$450 per annum is if you decide you can not afford \$5,700 – you can pay it off over twenty five years, \$450 per year. There is an interest cost in that and there is an administration fee. Some people will choose the first one – pay it off straight away, and others the option to pay over twenty five years. There was a suggestion that if you sell the property within that twenty five years, that we put a lien, a caveat or a covenant on your property, but we have decided not to go down that path in terms of paying it off if the property is sold because it is too hard to administer.

So that gives you an idea for Mourea residents as well and the difference is the EBOP subsidy, again \$285 per annum over twenty five years, and the Duxton Hotel – their capital contribution to the sewerage. The \$5,700 for Okawa Bay is the capital cost, it does not include the operating cost per year for all the urban and rural people on that scheme and we have set that for this year at \$306 per annum. That figure also does not include the approximate figure of about \$2,000 that individuals will have to pay to get the pipe from the boundary to their house. We have put in an indicative \$2,000 but that is something that the individual property owners will have to pay. It could be above, it could be below. We are putting the pipe to the gate, fence line or the boundary and then it is up to individual property owners to get it to their house. They are indicative figures, it might be plus or minus \$100 either way, but those figures will be published in our ten year plan to be published next week.

In terms of the urban sewer extensions such as Paradise Valley, those ones we are not sure whether they come under the sanitary works schemes but we will apply and if they do, great - and again the level to be determined by Rotorua ratepayers. We are not sure of that level yet, we have not had that debate but the balance of the cost of applying all the subsidies will be borne by the community.

In terms of our wastewater treatment plant, I want to pick up the point that in 1984 we knew there was an issue and the Council at the time went back to the Government and they upgraded the wastewater treatment plant. It was the best technology available at the time and it was decided to pump the waste up into the Whaka Forest. Since then, I think it was about

two years ago, we started methanol-dosing the wastewater treatment plant and this has proved to be an enormous benefit in terms of further nutrient-stripping the waste before it goes up into the Whaka Forest. We have seen some really good results coming back from the methanol-dosing facility.

The other one I just wanted to show you (slide not shown) was that we have just increased the Barden flow in its extension work which is now complete. These are huge costs that we have to go to to upgrade our wastewater treatment plant. As John said, they are not insignificant.

In the words of Barry Carbon, we have come up with a family of solutions. These are Rotorua District Council's, we believe they are locally driven, I think we have got huge buy-in from our community, it is expensive but as John Cronin said – we can not do nothing.

I will also pick up the issue that was pointed out earlier given that we have just been through five days of budgets to do our LTCCPs and my CEO is actually pulling his hair out at the moment getting them audited. It is a really frustrating exercise when Central Government says that they can not crystal ball two to three years down the track, yet we have to in our ten year planning cycle. We have to button down those future costs for presentation. I find that really frustrating. Thank you.

## QUESTIONS

*John Keaney – former Mayor of Rotorua:* Every public facility that the Council manages has to be over-designed by about 15% and once again, as someone mentioned earlier, there is nobody here from the tourist industry. That extra design work is required for public amenities that Rotorua District provides and it has to be paid for by the ratepayers of the district. So there is a big problem there to work out what the tourist industry should pay, but my question is: is it permissible now to impose a visitor tax or pan tax. That legislation has only been passed in the last couple of years, I think? What is the Rotorua District Council's view of the imposition of a visitor tax to help pay for some of this over-design?

*Kevin Winters:* Thanks for your question John. Yes you are right, 15% we over-design and we have 8,000-10,000 visitors per night into our district and that equates to something like three to four million visitor-nights that we have to comply with. In terms of a toilet tax/bed tax, we actually do that now because most of those big corporate motels/hotels pay a sliding scale for pan charges, the more pans you have equate to a sliding scale downwards, so they do pay a considerable amount of sewerage tax through hotels and motels.

But I guess the other debate we have been having recently is a change to capital value for rating. We have done a lot of analysis on that so far. Some of those big hotels/motels will pay a considerable amount of rates over and above what they pay now if they changed over to a capital value, as opposed to land value. But your question is quite valid about the 15%. Yes, we have a lot of visitors tonight that we have to accommodate.

*Richard Wilson – Resident of Rotorua:* Kevin, I find your \$91.45 million that Rotorua District Council is going to spend pretty misleading. I believe you are only going to spend \$1500 per property with the Central Government subsidy and the Environment Bay of Plenty

subsidy, it is not where you are going to spend \$91.45 million, it is more like \$1,500 a property, surely?

*Kevin Winters:* Yes, you could look at it that way Richard, but we have to fund these sewerage schemes while they are being built. There are subsidies from Central Government but we have only just got the money now for Mourea/Okawa Bay. So we have to fund these schemes and then we apply to Ministry of Health once they are built, they are in the ground and then we get our money back. We have to find that capital from somewhere to pay the contractors to do the physical work.

*John Green – LWQS:* That \$306 targeted rates for the effluent plant, is that only for households which are connected to reticulated schemes or is it for all households in the district?

*Kevin Winters:* No, that is a targeted rate only for those on the scheme. If you are connected you pay the \$306. People of Reporoa do not pay that because they are not connected to that scheme. But it is a uniform charge over the whole district. We looked at having different areas charging some more but we felt in the end it was beneficial to all of us that it is a standard uniform cost right across the district.

*John Green:* Just a supplement to that – does the Council still apply a 70/30 split on the costs, in other words 30% goes into the general rates and 70% only goes to the targeted rate?

*Kevin Winters:* No that \$306, 100% of it goes to running the wastewater treatment plant. We run sewerage, we run water and we run refuse in silos and those silos are stand-alone accounts, they are cost neutral, no profit. There is zero at the end of the year because they are stand-alone silos. So it runs the whole scheme, be it water, sewerage or refuse. So at the end of the year there is nil left in the silo.

## Three representatives of interest sectors Their views on the sharing of lake restoration costs

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### Represents Lakeside Residents

#### TRANSCRIPT

Tena Koutou katoa.

At the end of Tutanekai Street lies New Zealand's greatest environmental disaster and biggest National shame. Like the oxidation pond it has become, Rotorua Lake lies green and putrid, for the one and a half million visitors that come to our city each year to see. It is the legacy we are left with after decades of pumping treated sewage into its once crystal clear waters, the hundreds of tonnes of nitrogen and phosphorous from intensified land use in its catchments, and the impact of urbanisation around its shoreline.



How could this happen? Especially in New Zealand, which spends a fortune, selling itself as the clean green capital of the world with its 100% pure New Zealand campaign.

It is not the purpose of my talk to dwell on the past or apportion blame, but the past has to be recognised, before we once again become complacent and waste any more time. The Lakes are dying - time for them has run out.

The warnings were there forty to fifty years ago, and many of the solutions were known and attainable. The diversion proposal was first muted back in the early 80s when research confirmed the negative environmental impacts the intrusion of Lake Rotorua was having on Lake Rotoiti. Treated sewerage was being pumped into Lake Rotorua for about thirty years after serious concerns were first raised about the degradation in water quality and the first algal bloom was reported. These warnings were acknowledged, and then ignored while the Lakes slipped further and further into decline.

Successive Governments were their guardians, and were aware of the problems. Many high level meetings have been held by successive Ministers and Government departments since the early 60s. **Forty years ago!** They have stood on the edge of our Lakes and muttered "how bad it is, how sad it is, but what can we do? This is a local issue!.....REALLY? Is it not Governments role to set the policies, strategies and regulations that influence directly the potential impact of certain activities on the environment!"

**Forty years ago** was the date of major increase of development in the catchments - a time when the Lakes were already in trouble. Yet successive governments actively promoted economic activity with very little strategic direction or mindfulness for the environment. They have encouraged farmers to aim for higher and higher levels of productivity, without providing the framework for environmental protection.

An article in the Daily Post on the 20<sup>th</sup> of May 1964 reported a major algal bloom in Lake Rotorua, which was attributed to nutrient build up in the Lake. **How could this be?** Why weren't the brakes put on then? There were very good scientific indicators that there was a serious decline in the Lakes health, especially Lakes Rotorua and Rotoiti.

The fact is that up until 2002, all authorities, while acknowledging there were problems, ignored the sickness of the Lakes. The warnings that were there since the 50s and 60s were ignored by Local and Central Government, and when Lake Rotoiti finally flipped in the summer of 2002/3 all authorities were slow to respond to the crisis. We must acknowledge that we are in the mess now because of Local and Central Governments failure in addressing the Lakes problems that were identified decades ago.



And while we acknowledge the mammoth effort and progress made in the last three years, we fear that progress may again be delayed through lack of funding for the restoration projects ahead. The decline in the health of the Rotorua Lakes, especially Lakes Rotorua and Rotoiti is a result of a long history of action and then inaction....**which simply has to stop!**

We have all unwittingly helped to destroy what initially attracted us to this area in the first place, and I admit to being part of the problem. The lakes community accepts ownership of their share of the problem and are prepared to pay for lake water quality improvement and protection, in the form of a reticulated waste water treatment scheme. Our community pushed for it, and welcomed it. We acknowledge we all have a part to play and pay!



The degradation of the Rotorua lakes is the greatest challenge facing our district today, and their plight justifies spending the necessary amount of money to fix them. **But who will pay?** Is it fair to expect this generation of the local community to bear the brunt of the costs, when in fact the blame lies with the bureaucrats of the past who have been dodging responsibility for years? It is the Government who has a serious and overriding responsibility to put right the wrongs of the past and an obligation to protect these key environmental features. Something they should have done when they had guardianship of the Lakes. Funding for their

restoration should come from those responsible.

Firstly the Government hastened the decline of these key tourism assets not only by ignoring the warning signs, but by subsidising land owners to destroy hundreds of thousands of hectares of scrub and regenerating native forest and facilitating the sale and application of cheap fertiliser for the purpose of intensifying the land in the lake catchments. We believe Central Government must bare the full costs for legacy pollution!

Secondly by those who continue to pollute. Our community accepts the burden of responsibility for our share of the problem, and are funding a large portion of the cost for lakeside sewerage reticulation schemes. We have lost a large proportion of our potential property value because of the degradation in water quality, not to mention many countless hours of recreation because of potentially toxic algal blooms. We support the concept “polluter pays” and agree that a targeted rate be applied to the future polluters of our Lakes.



The area around the lakes boasts some of the most productive and efficient sheep and dairy farming country in the world. Output and net incomes for the New Zealand dairy industry are higher now than ever, and to sustain this farmers are relying more and more use of external inputs such as fertilisers. Water quality in areas of intensive pastoral farming is recognised to be poor, with most rivers in farming areas failing to even meet recommended guidelines. Fertiliser top dressing is still happening regularly in lake catchments, and cattle still have access to their waterways in parts. This fact has caused tensions between farmers and other sectors of the community.

One dairy farm can leach 6-7 tonnes of Nitrogen a year and while riparian planting and buffer zones are effective in substantially reducing phosphate run off they do not reduce the nitrogen load to water courses at all.

Some management solutions have been identified and yet changes in land use and land use management for the large part have yet to be tackled. Controls on land use are inevitable, for the long term health of the Lakes to be achieved. It is our central and local governments’ responsibility to make legislation that will allow farmers to make financially sound decisions and change, and to make it desirable to change!

**The Lakes ill health will not be improved if the present rate of nutrient inflow from land based activities continues.**

The lakes are dying faster than action is being taken! Changes on the land are going to have to happen now. We are already forty years past the point where action should have been taken. **Forty years and four lakes.** A report prepared for the





Ministry in the late 60s said “The lands in the Rotorua Lakes catchments are not suited to intensive use without careful prior planning as any further deterioration will immediately affect water resource values. Deterioration in this area will affect the economy of the area and the nation”.

Farmers in my opinion are delaying in finding solutions that will ultimately cost them money. They are hoping that science will find a way to allow them to keep farming in the way they have in the past. There lies a conflict of interest. Farmers are in the business of making money, like any other business owner. They are not capable of fixing the problem, because they have a financial interest not to make changes. No business wants to spend money to make less, and a significant reduction in nutrient output will amount to just that. No matter how you look at it! Government encouraged and subsidised farmers to intensify their land to a point where it is no longer sustainable. They must now play an active part in finding and funding solutions for that to stop.

The Rotorua Lakes are a key tourism asset, waters of National Significance; they are used by people from all over the world and New Zealand and contribute significantly to the local and national economy through tourism. Visitors too have been polluters of the past; what is being done to make them contributors to the cost of restoring our Lakes?



No single feature of Lakes affects people's enjoyment of them more than water quality. Poor water quality is having an effect on visitors to Lake Rotoiti and Rotorua in general, because it is becoming too much of a gamble for water recreational activities. International visitors are not getting what they have been promised in the brochures! Our Lakes have become a health risk to visitors! The more polluted and politically fragile the world becomes the more important New Zealand is as a safe clean destination.

The neglect of the Rotorua lakes has become a national example of environmental degradation. The issues for too long have been minimised and scientific evidence dismissed. Government should be feeling the pressure to find solutions, and the response should be similar to any other disaster relief programme. The Government has an over riding responsibility to protect the health of our community and New Zealand's reputation as a pristine, clean, green environment.

Our national and local governmental process has a long history of causing delays while setting up numerous committees to solve the problem, but the Lakes are telling us there is no more time or room for complacency. Government have at last provided some legislative framework. It is up to local government to implement the hard rules it will take to save the Lakes. The longer we take to implement the changes necessary to rectify the problem the bigger the problem is going to be.

In conclusion, I would like to read you an excerpt from an article from the Daily Post Oct 15<sup>th</sup> 1964.

**“The Rotorua Lakes have for far too long been crying out for remedial attention on one hand and protective work on the other. For an equally long and frustrating time, organisations and departments have argued the merits and denied responsibility”**

**Who will pay?**

History and the next generation will judge us all by our response to this question. When the bill is apportioned remember that it concerns the preservation of these scenic icons and the tourist drawing magnets in and around them. They must be restored and protected at any cost, for the sake of all New Zealanders in this generation and the generations yet to come.

Kia ora





Kath Peebles  
*Acting Chair, Progress Ngongotaha, Rotorua*  
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## **Represents Urban Residents**

Kia ora Tatou,  
Ka tu ahau I raro I te mara, nga haapu, nga Manawa waru o te Arawa  
Te Arawa waka, te Arawa Tangata,  
Kei te mihi, kei te mihi, kei te mihi  
E nga mana, e nga reo,  
Tena koutou, tena koutou

Ko Kath Peebles taku ingoa  
Ko panekiri te maunga,  
Ko waikare taheke te awa  
E Rere mai o te wai kaukau o nga tipuna-Waikaremoana  
Ko Ngati Hinekura me te whanau pani – nga haapu

E Uri o Ngati Ruapani ki Waikaremoana,  
E Uri Tehoe maumau kai, maumau taonga, maumau Tangata ki to po.

Thank you for inviting me here today as the Urban Representative on the lakes of Rotorua and the Rotoiti Action Plan Working Party.

Firstly I would like to acknowledge Steve Chadwick, the elected representative here today and members of the District Council and EBOP.

Today I am speaking for the multi-cultural, the bi-cultural, the mono-cultural, the women, the men, the families, the beautiful children, people of colour, people of monochrome, the grass roots, the flax roots, the retouched roots, the gay and the glum, the straight and the slightly bent, the transsexual, the transgender and the trans-Tasman, hopefully one day. I am representing them all here today.

I began this process long before Christmas by sending out a quick health email to Ian McLean – “what should I speak about Ian?” I also asked the local Member of Parliament, Steve Chadwick, what should I speak about Steve? Both gave me some ideas. Ian's response was to find out who pays for the costs of fixing the lakes. Steve's response was find out who cares if the lakes deteriorate even further. Both answers fit neatly into the symposium theme today.

I went about putting together a questionnaire that included those questions. I posted them out to over twenty five community groups in Rotorua. I also included a self-addressed envelope to ensure replies, or so I thought. To date, I have received three replies, a 12% response rate. I then asked myself, “could the questions have been too difficult to respond to” or “are urban ratepayers generally a little indifferent to the lakes issues?” “Are urban people connected to the lakes in the same way as the lakeside ratepayers are?”

You can be the judge today as I read out a list of the questions I asked and the responses from the three groups that represent a proportion of the urban citizens.

The questions I posed were:

- 1) *Does it matter to **you** as an urban dweller if the lakes get worse and worse?*  
Fortunately all three answered “yes it did matter”.
- 2) *What do you think as an urban person about **sharing the cost** of the sewage extension?*  
Two groups agreed – one saying “within reason look at a fair percentage” and the other one disagreed with a comment saying “that it would be only fair for those who receive that service”.
- 3) *What do you think about the EBOP proposal that Central Government pay 50% of other capital works?*  
Two agreed saying “this is the very least they should be paying” and one disagreed, “particularly if it continually gets added to our rates”.
- 4) *Who do you think should pay for the maintenance cost of the schemes?*  
One said “EBOP”, one said “Central Government, Ratepayers and EBOP”, and the other group said “there should be an agreement between Central Government and Local Government and each pay a percentage”.
- 5) *Do you think the targeted rate share proposal by EBOP for the rest of the Bay of Plenty is fair?*  
One replied “no”; two other groups replied “they did not know enough”.
- 6) *Do you think the cost sharing proposal within the Rotorua District is fair?*  
One said “no it is too heavy on ratepayers”, one group said “yes” and the other one said they were “unsure”.

I hope these answers may give you a guide to what urban ratepayers are thinking and what perhaps EBOP and RDC need to address or perhaps ladies and gentlemen, my skills in preparing a questionnaire may leave a lot to be desired.

It seems to me that urban ratepayers believe this is a Central Government, EBOP and RDC issue to sort out and when they do sort it out, please be fair and do not lump the ratepayers with a high cost – only a fair percentage. This also seems to be the general opinion from people I talk with; it did however give me great heart to read the comments on the bottoms of these forms, where they said the lakes are a major part of the environment to Rotorua and also that they are extremely important to all Te Arawa and the community. Hooray!

Therefore, I must conclude that urban people do value our lakes; they are not uncaring or unsympathetic, they just do not want to be lumbered with the entire financial burden for the restoration. I wonder though, do they have enough information yet to be connected to the issue? Information such as “what individually can I do to help improve the lakes water quality?”

For the future we need to consider how we might work to involve urban people in a wider strategic framework. Perhaps the RDC targeted rates may consider giving small communities a lower rate to pay, especially those communities that are already working out there and making a difference to the water quality.

We need agreed strategies and we must focus on partnerships around those strategies. I know the money available for distribution across the community groups from the Environment Enhancement Fund is substantial, but I also know of one group who were funded money three years ago to build a wetlands but they have not drawn down on that money because they were expecting Environment Bay of Plenty to facilitate that work. We therefore need to provide more information and leadership or perhaps give more support in recognition to the leaders in our communities who can initiate and follow through with those environmental projects. I believe that our communities, our regions and our country all work best if we coordinate and work together.

I had a thought: perhaps we could start with some shock treatment as a way to initiate engagement and discussion! Would we want to see large signs on the entrance ways to Rotorua saying “Haere Mai” “Welcome to Rotorua” and underneath a picture of a large dead lake surrounded with toxic black and white signs saying “Do Not Enter”, “Poison”, “Stay Out”. A caption underneath could be ‘What can you do to prevent this happening?’ Signs like this could activate urban ratepayers.

I am proud to say that we do have wonderful urban leaders in our Rotorua community and in particular in Ngongotaha where I live. We took responsibility way back in 1996, we looked at our local streams and wondered what we could do to improve the environment, therefore doing our share to improve the water quality. Our history has always been one of cooperation in Ngongotaha. We engage with wonderful passionate leaders, people like Sue and Jaap van Dorsser, Ham and Jan Gifford, Russell White, John Conway and Sharon Beckett. We organise stream bank clean-ups, stream bank plantings of natives, projects like the Ngongotaha Stream, the Awahou Stream, and the Awahou Marae.

From our community leadership and foresight, there are many other projects in the region; for example the Hamurana Stream Care Group and the Mount Ngongotaha Restoration Group. There are others in the region that have all followed suit and many have copied our planting style that we proudly call “Jaap’s way”. All are volunteers who have put in many hours and I want to acknowledge that.

I would also like to acknowledge the tremendous support given to projects and programmes from the EBOP Enhancement Fund Initiative, EBOP staff and Rotorua District Council for financial and resources support, and of course the Te Arawa Trust Board, the Maori landowners and the Government who is very much committed to continuing to work with the Local Councils and Iwi to develop medium and longer-term plans to address the water quality problems in the Rotorua lakes.

You do make a difference to the lives of the communities and what you do is valued and appreciated. Rotorua is a strong community of values and we all feel a part of that.

A strong focus of our talks yesterday and today has been on the environment status, the cost and the economic values. Today I wish to emphasise cooperation and information for the common interest of our region.

I hope everyone will return home excited by new ideas and visions and further cooperation, knowing that we are all responsible in assisting with the improvement to our lakes and the lakes water quality. Be it physical or financial we all need to be accountable and urban people will play their part too.

No reira tena koutou tena koukou tena tatou katoa.

Gifford McFadden  
*President Rotorua Taupo Federated Farmers*  
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## **Represents Farmers**

### **TRANSCRIPT**

Anaru, I would like to acknowledge the help that Te Arawa has given Federated Farmers and acknowledge the trust that you have given us in joining us to form the Rotorua Lakes and Lands Trust.

We welcome Central Government involvement in this problem because we feel that it brings a balance to a situation otherwise being ruled by hysteria and spin. We are very lucky in this area to have Steve Chadwick, our Member of Parliament, getting so many Parliament Ministers to the Symposium. Barry Carbon (*Chief Executive, MfE*) was also here this morning. I remember what it was like when Barry Carbon came here for the first time and that was through the efforts of Steve Chadwick. I would acknowledge the work that you have put into this problem. It is not an easy task and I think sometimes you probably think it is the only task you are doing as an MP, but thank you for the work you have done.

All development causes change; farming is no different from anything else. We spend far too much time demeaning farming and not enough time finding solutions. Ian McLean mentioned yesterday that we are nearly up to speed with the science: not as far as farming is concerned - it has barely started. We are applying again for funding for some more promising lines this year. The application will be submitted in a couple of weeks and the outcome should be known in about three months. We will not be able to start it until next spring, and it will take three years to get a result.

We are talking about sustainable farming in sensitive areas like lake catchments. There are two management sources of nitrogen in Lake Rotorua and they make up a third of the load each. There is some dispute about this but EBOP use different figures from Environment Waikato in Taupo. The actual figure being used by EBOP was the figure given by the Parliamentary Commissioner yesterday, something like 340 tonnes from pastoral areas. If you allow for attenuation, it is down about 300 tonnes – so with the stroke of a pen you can save 200 tonnes, but we'll have to have some arguments about that!

The second is sixty years of sewage sludge in the bottom of the lake. I have been quite surprised that nobody has talked about that much. It is as if having spent money on the sewerage, it is no longer our problem. Well, it might not be my problem, but I am afraid it is yours.

In the 60s, 70s, 80s and 90s Government spent nearly \$500,000,000 in today's terms on stream conservation in the Central North Island. That included the Kaituna scheme and a lot of that was actually funded by farmers – farmers had to make a contribution to get that Central Government money. Regional Councils at that stage did not put a cent into it; they got 25% for administering the scheme. So we have already put some money in there and

quite frankly, we thought we were doing a really good job; we were quite proud of ourselves as environmental people, and then we found out about nitrogen and it all just turned to custard from there on in.

It has succeeded in its conservation purposes but it has been useless for nitrogen, we have accepted that. I have not taken this out to the farmers because we are finding out new things every day. From a farming point of view; we have quite a bit of difficulty getting information.

This photograph shows Raglan Harbour. I am going to talk about what has been done in the Raglan Harbour in the last ten years. It is a system like Lake Rotorua, a large complex system. Ten years ago a group of locals starting fencing and planting all the waterways in Raglan Harbour. In that time Raglan Harbour has gone from algae blooms to no algae blooms. Eighteen hours to catch a fish, to fifteen fish in an hour. Half a cup of whitebait to half a bucket of whitebait.

What are they doing right that we are doing wrong? Why aren't we getting a return on this half a billion dollars that we put in? Federated Farmers put in \$10,000 of it actually.

This is a photograph of a Raglan Stream, a nice looking little stream, before they started the work (*not shown*). The Kaituna Catchment Scheme has not achieved anything like the same results. The answer will be no surprise to Kath's group at Ngongotaha; the reasons are blackberry, blackberry and blackberry.

A Blackberry covered stream



This photograph (*left*) was taken in Reporoa, from a bridge. The stream bed comes down through here; it is two or three metres down to the water. If a hundred year flood went through there, that blackberry would stay there because it would go underneath it, there is that much there.

This is the Wainui Stream in the reserve at Holdens Bay (*not shown*). You can see some of the plants growing there. It is not as good as it should be because this (*next photo, not shown*) is Ngati Whakaue's land across the other side of Te Ngae Road and this is the watercress bed that Rick Vallance made. This was put in a year ago when they pulled the stream apart - you can see where they put the concrete in there and now it is regenerating.

Mangahoanga Stream SH5 Reporoa  
Down stream



This is a stream at Reporoa.  
It looks quite a healthy little  
stream there but they have not  
had the cows in lately.

Mangahoanga Stream SH5 Reporoa  
Up Stream



Here is the same stream  
looking upstream.

I am not saying here that we should not fence the cows out but what we have got to do is manage them. We have not managed them, we have not spend a cent on managing them. We have done some work; I am not too sure what EBOP has done. I know iwi spent quite a bit of money on clearing out poplars and willows that were falling over but as far as maximising the environmental benefits and optimising it - no.

Water quality – half a billion dollars – it should be optimised before we start spending taxpayers' money on land use change.

Farmers are ready and willing to pay their share of any future costs but please do not see this as a blank cheque. We are willing to pay; we are willing to pay our share of our problems. We are willing to contribute to the general rate of the District Council and the Regional Rate. We are not willing to be a chicken waiting to be plucked.

Federated Farmers wishes and expects to negotiate with both Regional Councils to reach an agreement on funding. As for the lake sewerage sludge, I do not know how to get it out and I would not be willing to pay for it if I did because I do not see it as a farmer's problem. We think we can fix our problem and so therefore we get a bit impatient when people want to load a lot of costs on to farmers. We have not even tried to start fixing our problem but already people are saying, you are the worst polluters therefore you are going to pay the most money.

So I come back to you, pay for yours and we will pay for ours. Thank you.

## **Perspective from a local M.P.**

Steve Chadwick – MP

*An unexpected but welcome additional presentation to our Symposium*

### **TRANSCRIPT**

As your MP for this region it is lovely for me to get five minutes to speak and in a nutshell, there are a few things that I have been dying to say yesterday and today. Firstly congratulations to Lakes Water Quality Society for getting this symposium going; and you can see by our three representatives at the table before, we still have not quite hit consensus but I can assure you it is a difficult job to do that.

I want to congratulate the Rotorua District Council because I was a Councillor before I got into Central Government, and this Council did invest in the non-sexy things of stormwater and sewerage. We really did do what we thought was right based on the science at the time. Regional Council, congratulations on your work too and so many Councillors coming from this entire catchment is really heartening for us to see here today.

Anaru, I also would like to acknowledge the role of Te Arawa. I had a small part to play in facilitation and mediation of the Te Arawa Settlement. It is very exciting to know that the bill will be going to Parliament very soon. It is another step on this very complex journey.

You do not go into Government to do nothing, I just want to assure you – things like sewerage subsidies do not just happen on the whim of a good idea. This was part of a plan of policy development over a long time, ready to go when we got into Government in 1999, and part of that is about the ability to pay and understanding that communities reach a point of tension from rates and regional rates and there is an inability to meet the total costs of infrastructure. District Council Mayor Kevin Winters has already written to us to say “can you give us inter-generational assurance that the sewerage subsidy will be there?” Well no, it is a brave Government that gives that assurance for the next twenty years but I think the principle of understanding the need for the subsidy is certainly well posted.

My job in all of this is simply as a signpost and a facilitator. I did help to get Regional Council and Local Government under Mayor Graham Hall, with Anaru Rangihueua down to a delightful meeting in Wellington with Paul Dell, where we met Marion Hobbs. What we achieved from that meeting was a very clear understanding both with the Ministry and with the Minister that our lakes are a national treasure. We do not have to argue that here. Do we understand in the national perspective that our lakes are iconic? They certainly are.

I am very heartened by the approach of the Rotorua Lakes Joint Strategy Group with the work that is going on there and I congratulate Paul Dell – he is leading the work and the linkages with the Ministry. Tim Bennetts, who is here and very quietly speaking in my ear over these two days, saying this is happening or that is happening and perhaps we could be doing this better, or we need to have a look at that. Thank you.



Marion we thought the Fraser Basin Council was a wonderful concept, that is something that we need to look at and learn from. The strategy group acknowledges it is not set in concrete. We have not got it all right and we certainly have not got all of the answers. I have really enjoyed getting the Ministers here to actually go out and meet both the Regional Council and the Local Authority, those working on the Strategy Group, and going out to meet community groups. That is where I want to acknowledge the work of community groups such as those led by the Lakes Water Quality Society. You just see the lakes through a different lens, it is something that you see differently and you need the opportunity to feed those points of differences and to finding a solution that is sustainable and durable.

I can assure you that now in Wellington, the Minister is well engaged in understanding the issues. I do not actually see it as a “who pays” issue and I am sorry about that. I see it as an opportunity and if we look at it under the Sustainable Water Programme of Action, we are actually going to find some exciting ways of looking at the opportunity of managing the resource of water and in the end, making our lakes so much more healthy.

I think we need to look at those Lisbon principles (Costanza, Millennium Ecosystem Assessment), I think they are something that we have not entirely factored into our thinking. I loved the idea of the Charter for Sustainability. I think that is something that we are almost near in the way we are all collectively looking at our lakes and the problems of managing our lakes water.

Kath mentioned about the townies and I am a townie and I look over the lakes every morning when I am lucky enough to be home. I look at the lakes and I actually hear the kids out there in the canoes and the waka training, and it is beautiful and they are iconic. But you know, we are not engaged – I am, but my neighbours only worry about the trout flies, they do not actually look at the planting around the lake margins, they do not see those things as solutions that make a difference. They do not connect yet when they wash their car three times a week, where does that water go, do we need to do that, how often do we hose our garden and are we indirectly responsible for the status and the health of our lakes? I do not think we are really engaged yet. Kath had not told me and I am not surprised by that response.

The other aspect that is in those Lisbon Principles is about communication, education and participation; we have got to do more work yet. Marion, your comment at the end that we have got a big job to take care of paradise, we are all here because we all care passionately about it.

I want to give you my assurance as your local representative, I take this very seriously. I did not become the Chair of the Local Government and Environment Select Committee just by chance, I lobbied hard to get that into my portfolio so that I could take a leadership role on helping us fix our lakes in the long-term. That work is going to be a very exciting programme of action that will come before the Civic Committee. I will give you my undertaking, with Tim beside me who will keep correcting me, to go out to others in the community and I will keep the links up with the Ministries. I am sorry David Benson-Pope was not here today but actually, the bigger work programme that he had to deal with was the merger of Ministry of Social Development with Child, Youth and Family; so sometimes we have to accept that Ministers can not be here. I have really enjoyed Barry Carbon's role in the Ministry for the Environment.

It is so exciting and I think one of the treasures that we do not realise here locally is that we have got Bill Bayfield as our new CEO of Environment Bay of Plenty. I think we are going to get ahead with looking at the tools and examining the tensions that will inevitably arise about who pays for what, but I see them as opportunity costs, not a burden of cost. Thanks for that.

## OPEN FORUM

*Barbara Hunt, Farmer, Lake Rotoiti:* My question is in response to Rick Vallance's presentation yesterday where he suggested that farmers need to think out of the square and work hard at solutions because if we think laterally enough, things will happen. I actually agree with him. I am thinking of Joe Farmer who owns his couple of hundred acres and operates probably in overdraft most of the year, because that is a fairly typical scenario, I suspect, for Joe Farmer; but he would like to participate in this lateral thinking in the role of farming and lake water quality. Where might Joe Farmer go to participate in a lateral thinking forum?

*Rick Vallance, Ngati Whakaue Tribal Lands Trust:* That is an excellent question, because I think that is part of the nub of it. Some of the most exciting innovations in farming have happened by farmers dreaming up amazing solutions. That was my point, with the help of a few scientists of course. One of the critical things we have got going, which perhaps is not well-known, is the Sustainable Farming Fund Research Programme, a million dollar research programme and we are kicking off on the next leg which is about the same I think. We are spending a lot of money that is either going to solve the problem or we will accept we have to literally change land use. I suspect we will find some good answers.

How do you participate? We have run one already and we are running the next one on 24<sup>th</sup> March, so two or three times a year, in autumn and spring anyway and maybe another time of year. We hold these meetings in the Woolshed at Wharenui where the scientists tell us what they have discovered and where we as farmers can have our break-out sessions and participate and think and come up with ideas. So we have put this process in motion and I think that that is where the answer lies.

*Paul Dell, Lakes Project Coordinator:* From Environment Bay of Plenty's perspective, we are very keen in engaging one on one with farmers. We have some talking to us at the moment about what they can actually do with their properties and we will bring a lot of experts to look at that and see what remodelling is possible. We also have the Land Use Focus Group, Rick, that you Chair, which is part of Rotorua/Rotoiti Action Plan Working Party, where we are trying to get people together and anyone can come to those meetings and we advertise those. We like to see people come along so they can ask questions and we try and get a flavour for what people are thinking. We do not want to be in the situation we saw yesterday of being prescriptive. What we want to do is try and set the broad environmental boundaries and then let people think within those boundaries of "Hey, what can I do, what are my options?"

*Councillor Jim Pringle, EBOP:* While we are talking about farmers, I would be interested (probably calling on Paul again) to address an issue with keeping the balance. We had a statement made this morning which is probably correct in its own context, but could have left the wrong idea regarding the sewage degradation to the lakes – a statement was made that that was only 5% of inputs. Having been the individual that fought very hard for the subsidy that is now in existence, it does not quite tie in with the figures that science, etc. came up with during the effort that we made to get that subsidy in place. I did discuss it with Paul and I think he could possibly put that into a better context, if you would do Paul.

*Paul Dell:* Yes, thanks Jim. If you looked at the Rotorua/Rotoiti nutrient budget that I put up in my paper the other day, from the urban environment you will see a straight translation of about 8% from the sewerage areas within the urban environment. But when we look at the reality of what it is doing, if we look at Okawa Bay, the fact is in that particular community, reticulation will have a major impact on what is happening in Okawa Bay. We also have other communities like Hinehopu and Gisborne Point where we are not just talking nutrient issues, we are talking bacteriological issues as well. We have to take this holistic approach to what we are trying to do. I think others have also said reticulation long-term is about future-proofing the lakes. When we get into places like Rotoma and Tarawera, and what is called the manageable nitrogen, those septic tanks contribute about 20%. We have to recognise that we can not necessarily put a straight percentage against something and say that is it. There is a lot more complexity and I think the programme has certainly looked at that.

*Ian McLean, LWQS (Session Chair):* The point is it varies from lake to lake and from parts of a lake to parts of a lake, and for some lakes it's only 2% and for some lakes it's much more.

*Don Atkinson, LWQS:* I am concerned that the Rotorua District Council has promoted a great improvement effectively within our lakeside sewerage schemes and I commend them for that. But they have not really raised the issue associated with changing the District Scheme to effectively allow some properties to migrate out of farming into lifestyle blocks. Certainly there are some initiatives being taken and I congratulate Rick for his, but if this was approached on a district-wide planning basis, I think we could have a far better discussion within the community about why we should be doing it. Effectively if that resulted ultimately in people being able to do it as of right, it would promote a significant reduction in the amount of nutrients that are going to end up in the lake. I am not too sure if there is anybody from RDC here that might like to comment.

*Ian McLean:* Would anybody from RDC like to respond? *(There is no-one from RDC here now.)*

*Don Atkinson:* It probably illustrates the concern they have.

*Ian McLean:* I think this is a very important issue, particularly the effect of Variation 12 of the District Scheme, and the question of the land use planning which was designed before the state of the lakes was recognised.

*Gerard Horgan, Royal Society of NZ:* We have heard over the two days on a number of occasions of the advantages of the cap and trade system for nutrients and it works best when there are significant differences in the costs of removing nutrients one way as opposed to another way. There were examples yesterday of nitrogen at \$200 a kilogram and \$1.48 a kilogram, and again today and I realise that the wider reticulation is not simply just to remove nitrogen and phosphorus from the lakes. But is there any place, in all the various analyses that have been carried out and the various options that are proposed, where there are some dollars per kilogram of nitrogen removed so that there is some idea of cost-effectiveness in terms of where you are concerned with nutrient removal. This scheme will remove nutrients at x dollars, this one does it at y. I guess that one should probably go to Paul Dell.

*Paul Dell:* Can I say that this is work that we are looking into, this whole cost benefit analysis. Tikitere is a good example where we have three options – diversion, treatment through the sewerage plant, treatment of ammonia with a zeolite-based material, and possibly long-term reinjection if a power proposal goes ahead. Wherever we can find options that are competing, then cost benefit becomes important, but while a lot of focus has gone on to the slide David showed the other day of \$200 per kilogram, say, for the sediments, we know from the modelling that if we go and change everything in the catchment and it might be a bit cheaper, it could take only two years before stuff starts happening again in the lake, without doing something about the sediments. We have got to be careful that when we do take cost benefits, and we will certainly be doing that work, to the community, we package it so they will see that you can not just necessarily trade one option off against another because it is non-tradable in terms of the environmental outcome. It has to be put in context and we would certainly not want to try and just go and do something because we think it is a good thing to do, we can only spend the dollar once, so that would certainly be part of the programme.

*Ian McLean:* I think Gerard's question is a very important one for the future and not the cost benefit, but the actual relative cost for removing a unit of nitrogen in different ways.

*Richard Wilson, Rotorua:* My question is to Marion Robinson. From what you have heard in the last two days, do you think the community, the Rotorua District Council, the Regional Council and Central Government are on the right track and if not, how can they do it better?

*Marion Robinson, Fraser Basin Council:* I want to say that I do not profess to have any answers. All I can say is that I can show you what we are doing and hopefully you can learn something from that, because we are all learning about this exercise together all over the world, not just here and in British Columbia but elsewhere as well. But the one thing that I would like to say is that you might benefit from an impartial facilitator. You might benefit from dealing with the social or the human side of this, because you have absolute strength in science and you have Government; you have all the ingredients but you can carve yourself an easier pathway by having some facilitation to bring the human side together on this. The strong messaging that I have picked up is around collaboration, about the way people get along together and maybe that will speed your pathway.

*Bryan Riesterer, Deputy Chair, EBOP:* David Hamilton made a comment on the valuation that he had for his lakes, he talked about \$10 million yesterday and I tried to infer to him that he had it wrong. I am sure that he will now contend that I was right and he was wrong, but he would actually like to put that value back up. Just an aside from that before he does that, everyone heard how wealthy the Regional Council is, which is a load of codswallop really, but can I say that as Chairman of Quayside, we are very interested in finding three or four dairy farmers who wish to look at an energy digester that could create electricity within the Rotorua/Rotoiti catchments. We would be prepared to look to fund a business case study for that and also look for investment. Just to give you an idea, we are expecting a return of about 15% ROI, so that is what we will go for. But we have not seen anyone put their hands up yet – we are quite happy to look at it and if anyone wants to put their poos down our way, I am sure that we can help facilitate that. Thanks.

*David Hamilton, Chair, Lakes Restoration and Management, University of Waikato:* I left a zero out and it actually went the other way. For the value of the lakes - my initial estimate was \$10 million and it actually comes up to \$100 million per year, which is for Rotorua alone. But I do get one up on you too, because you forgot that it was in US dollars and if you convert US to NZ dollars, then you go from about \$70 million to \$100 million.

*Ian McLean:* This value is the value of lakes using Professor Costanza's planetary average figure. These lakes, of course, are much more beautiful and of much more value than most other lakes around the planet, particularly ones like Omapere and Horowhenua and Wairarapa which are just shallow puddles and of no real significance, but these lakes are real lakes and important ones.

*Bryan Riesterer:* What Professor Hamilton said about the \$100 million which is the value of these lakes to our community. We are far better off putting up the figure and saying we want to look after and protect \$100 million. If we put up only \$10 million, we are actually losing the plot, so we need to focus on those values and make sure that the wider New Zealand community clearly understand that the value of these lakes is a whole lot more. If you took the whole lot together, it comes out at around \$200 million - having adjusted for the US exchange rate. Thank you.

*Ian McLean:* I think the figure is per annum, it is not a total figure. As you are all quiet for a moment, can I ask a question and it is a question of RDC and EBOP and Central Government. It struck me listening this morning that the quality of engagement on the issues was not as good as it should be. Each side was making comments about problems they were having in dealing with the others - and that the Joint Strategy Committee seemed to be suggested as the prime vehicle for engagement, when it is hardly a vehicle for negotiations. And the question really is - are you satisfied with the quality of engagement between the three of you over the funding issues?

*John Cronin, Chair, EBOP:* Yes, we are satisfied with the engagement, the strategy working group of Te Arawa, RDC and EBOP is working well. It is ready to springboard into a lot more action now. There was a little bit of a hiatus because you had the election period and there has been a change of Minister. I do not think you have anything to worry about in that area about communications. We have always a good rapport with Steve Chadwick and it is constantly being liaised with Government all the time. One that has not got enough credit is Tim Bennetts sitting alongside Steve there. We are pretty satisfied with it. We can always do better, we will do better.

*Steve Chadwick, MP:* I think the engagement is outstanding and quite unique, but if you feel we need to go faster and I sense that from representation like Sally Brock, like "Let's just see this all getting going". We have all been saying we must have the science or we have got the science, we want to move on the things we have planned. I think you have to trust, and this is an issue of trust in a relationship with a group that will thrash out the arguments in Wellington about the affordability of some of these major capital projects. The message is very clear to us through John Cronin and through the Mayor, and with Tim as the agent. I think if there is a sense of frustration, then I am always prepared to get those relevant people to meet the Minister again. It is not a problem, they have an open door policy.

If you are looking at a joint official looking at some of these capital projects, it does mean you are subject to Treasury crawling all over you and then it makes you more liable to the comment about the perception of Bay of Plenty sitting on a pot of gold. We are not frightened of that and that is where we have moved beyond other projects. I prefer our project approach; it is more durable than just a lump of money dumped in Taupo, hoping to sort out the Taupo solutions. What we need in Government is flexibility in the budget cycle, when we have everything right, we will be ready to put in a budget bid that reflects the consensus that the Joint Action Group has come up with. That is exactly what is going on right now. You are doing outstandingly well. I have no unease, because I come from a community development background, it is about the smaller people and how those groups feel.

I was pleased to hear farmers saying we want a chance to come across and have an input in some of these innovative solutions. You know, I like the cap and trade, although I have not put much thought to it myself. Should we take that to Vision Rotorua saying "Here's a perfect opportunity for Rotorua for the next 20 years". That might be the thing that we put to them at the end of today, but yes they are working brilliantly.

*Councillor Kevin Marsh, Western BOP District Council:* I am a farmer from Te Puke down by Maketu. I have been going to a number of meetings down there over the last few months and it is interesting to hear the people up here saying "Well, we've got to get rid of this and it's going to go out of our lakes". But the people down there say they do not want it to come down in the state that you are going to put it down in. They have got a different point of view, "it's coming down, where it is going to go?" They will take the water as clean, but they are concerned. It also concerns me a little that those people down there should be at this forum too to put their point of view across. At the moment I hear one side, but I am in the fortunate position to see both sides. They have got a real problem with what you are going to do - and I understand where they are coming from. Maybe they are right, maybe wrong, but I think you have got to get together with those people to see what they want, rather than just say "We're going to put a weir in down here to put it down the Kaituna". They have got a problem with that. Thank you.

*John Green, LWQS:* Can I make an observation and I would like David or Paul to comment on it. It seems to me that it is a win-win situation for those down the river and for us, because Lake Rotoiti is the area where the algae blooms incubate, so you have got a choice. If you do not put the wall in, you are going to get more and more density of toxic algae. If you put the wall in, the models are telling us that you will not get algae bloom. Algae bloom will not create itself in fast moving water which is that stream, so you might have slightly more nutrient levels in the water, but I am sure I would sooner have the trade-off of higher nutrient levels, rather than toxic water coming down which you cannot use and will poison the shellfish and everything in the river. So I think it is a win-win for everybody to be honest with you - but that is only my observation.

*Brentleigh Bond, LWQS:* I have sat here and looked at some very interesting presentations over the last few days and there has been considerable information, particularly about sewerage schemes and this morning of the costs of these sewerage schemes to the various communities. One thing I have some concern with that does not seem to have been covered here at all, is the significant number of houses around these lakes, and I talk particularly of Rotoiti and Rotoehu/Rotoma, which are going to be caught up in this On-Site Effluent

Treatment System. The latest information I have had from RDC is that the private hi-tech systems in these houses are going to cost something like \$20,000 each and if you multiply that by the number of houses that are in that small area, the figure is getting significant. There has been no indication at all that I have seen of any subsidies being talked about, thought about or offered. But these people are real people around the lakes, they happen to be in an area that is not going to be serviced by a sewerage scheme and they are going to have to bare the full cost of this. Is that fair?

*Ian McLean:* We've got nobody from RDC here. Well, the Deputy Chair will take precedence over the Group Manager, I think, Paul.

*Bryan Riesterer:* Can I just say that we have just done our On-Site Effluent Treatment Plan and one of the issues that came across was exactly that which you talked about with these other lakeside communities, having defined some form of sewerage treatment. One of the observations that we made was that a composting system in a lakeside community, a fully blown, proper, really well-run composting system, would not attract Ministry of Health funding, because it does not necessarily deal with the bacterial load of the composts. In other words, Ministry of Health gave many submissions to us on the On-Site Effluent Treatment Plan about "Please do not allow the distribution of composted waste from human toilet facilities at all". So in terms of getting us over that ground, we really need to talk seriously with some of the other Government Departments about that issue.

As to the special treatment systems, it is my understanding that we are not necessarily talking about one treatment system per house; they could in fact service four or five houses. I also believe that the dialogue between Rotorua District Council and the Regional Council whether some of those smaller communities require subsidy has not been had and we await with interest that debate. We are having to look at it. Paul may wish to comment on those other On-Site Effluent Treatment systems but I understand that they can deal with more than one house.

Before I sit down, I would like to comment on Mr Green's comments about a win-win situation for the people of Maketu. Clearly, they objected to the wall because they wanted Lake Rotoiti to continue to be the septic tank that it was and that they actually got a better deal after five years in terms of the length of time it took to go round that lake. They believe that the straightening of the Ohau Channel and the stop logs put on the front end of the Ohau Channel to keep Lake Rotorua in place and also the gates, are an impediment to them. The people at Maketu are concerned because the water has been taken from their estuary, and they really want that reinstated. That water has as much value to them as your lakes have to you, so what Kevin has said is a real issue. It is not about the effluent from Rotorua ending up at Maketu, it is about the fact that there is a Kaituna Drainage Farming Scheme which includes the Okere gates, it includes the straightening of the Ohau Channel, it includes the stop logs at the front end of the Ohau Channel that keeps Lake Rotorua at a set height, it also includes the Ford (Kaituna) Cut that has deprived their estuary of all of the water. So you talk about a win-win and we are the politicians trying to make it a win-win. Like Kevin, I do not know where we go from here. Thank you.

*Ian McLean:* Thank you for that Bryan, I think you have significantly added extra elements to it and it is clear that Environment Bay of Plenty have got significant communications



issues with Maketu, but I do not think we should spend more time on that issue at this symposium, because there are not many people from Maketu here and it is not central to our Symposium. Thank you for raising it Kevin and thank you for contributing to it.

*Paul Dell:* Ian, I want to add to that earlier part. Brentleigh, we are trialling five package systems at the moment and we have found two of them that we believe will meet the specification and this has been funded jointly by Environment Waikato, ourselves and Rotorua District Council. What we have seen ourselves doing is trying to create an environment where we can make sure these systems do perform and the community do not waste their money. As Bryan said, once we get an understanding for that, we can start talking to manufacturers about how we get these systems to serve multiple houses and then drive the price down. If you are talking \$18,000 between two houses, immediately it is a different cost. This is the sort of leadership that the region has to give here because it does not exist anywhere else in New Zealand's structures at the moment.

*Don Atkinson:* I am concerned that we have had some debate around the community cost but we really have not got it focused. From what I understand, Government potentially pays half of the cost, EBOP on their part will pass their 50% on to the community, divided up between the whole region and our own. On that pie graph, about 30% will be a community cost from the EBOP side. On the District Council side and the sewerage costs, we understand that to be a 50/50 cost. If we average those two numbers as a rough way of looking at it, this community effectively is going to be paying about 40% of the total cost. I then think that is a big bill and I look over the hill towards Taupo and hear this morning that their community effectively paid 20% of the cost. I also hear from the commentary from Government that "Hang on, you may in actual fact not have this 50% in the bag even yet, don't count your positions yet, we haven't decided whether the economy can stand the bill". You start as a community person to become very nervous about how we are going to address this critical issue. This is what we are here about today and my understanding is that this community is effectively looking like standing 40% of the total cost; that is if the Government thinks the economy is strong enough. Would someone like to respond to that from the Government, perhaps Tim Bennetts?

*Steve Chadwick, MP:* Good question, it certainly was not from me about where the economy is going. You have got the guarantee of the subsidy, if the application stacks up and it is based on need and the decile factors of that community. Your District Council has put the application in to Government. We can not give intergenerational guarantees; no Government could guarantee that subsidy would be there forever. I do not know what the opposition's policy is on a subsidy for water schemes or drinking water, which is another subsidy that we have in place. So it is impossible to give you that guarantee.

The guarantee that we can give is that when an application does come to Government, we will have a good look at it and make sure that it stacks up on a fairness basis; and that is what is happening right now. We can not future-proof but we can give you the guarantee that you are seeing a lot of funding going into the lakes. That is what Barry Carbon did point out. It is great to see that sewerage subsidisation is being factored into a Government contribution now; but no one could put their hand across their heart, that would be absolutely improper of me to do that.

*Ann Power, Taupo District Council:* In relation to the 20% that was mentioned this morning, one of the things we need to be clear about is what that 20% is for – it is not for waste water – let's be very clear about that. Taupo District is paying for all its waste water upgrades and we are having huge difficulty getting subsidies for our waste water schemes because they do not comply with the criteria set for public health. There may be environmental issues but they do not qualify on public health issues; so let's be clear about that. The funding that is coming from Government is only part of the costs of our lake clean-up. We are talking about a much, much bigger sum in terms of what it is costing us. That funding is purely for the public fund that has been set up to address our 20% to actually manage the nitrogen from the catchment; it is not for waste water, it is not for work that Environment Waikato is doing in terms of putting together rules and applying those rules, it certainly does not cover any of Taupo District Council's costs. It is purely for the public fund.

*Peter McKinlay, McKinlay Douglas Ltd:* Really just following on from what Ann said, in terms of the credibility of the arguments about cost in Rotorua as opposed to Taupo, it is critically important that you actually get your facts right, that you make sure you are comparing apples with apples. Ann's point about what Taupo is carrying is actually very, very important, as is the issue that in terms of the sewerage upgrades which Rotorua is facing, my personal guess is that regardless of the water quality issues, because of current views about minimum quality standards environmentally, Rotorua would be facing costs for sewerage upgrade anyway, as all Local Authorities are. So it is very easy to pick up an issue about a percentage of cost or something or other and run with it and get completely off track. If you are making a case to Central Government and your case is not robust, you are likely to do yourself more damage than otherwise. That is very important in terms of debating the future of the Rotorua lakes clean-up, whatever society says and whatever other people say, it is factually correct and has properly unbundled the issues that are involved, because otherwise you haven't a case.

*Ian McLean:* In fact the Rotorua District Council is spending money on the city waste water plant, several million dollars. I am not sure if it is \$2 million or \$5 million, which does not get subsidised at all as I understand it. I am sorry there is no one here from Rotorua District Council, but there are substantial sums that they are paying that does not get subsidised.

*Bryan Riesterer:* I want to respond to what Don Atkinson said. The rating system for Environment Bay of Plenty has been worked out over all of the rates. We have significantly altered the targeting of our general rate right through to target the lakes, the buses and the weeds and pests; in other words we have specifically targeted our rates to the 'user pay' principle; just like our river schemes are targeted that way. To give you some understanding, I am on a targeted river scheme rate in Opotiki; my property values are about \$600,000 and I pay \$250 targeted rate to prevent the water from the Otara River flooding my property. If, in fact, the water did flood my property, my house is still 150 feet above the river; so we are paying for things that we could equally argue that we are not getting.

Can I make one last comment? As everyone knows, tonight is Census night and to help Okareka and the Green and Blue lakes to get the index of deprivation that they require to obtain the subsidy, can I suggest that they reduce their income by about \$25,000 per person and the whole community should do it and then we will get to the right index level. Isn't that right Steve, we would get it about right? Thanks.

*Ian McLean:* You will be suggesting that we be careful as to what ethnicity we put down on the census so we alter the balance of seats of Parliament too, if we wish to.

*Rod Stace, Lake Okareka Resident:* This issue of ability to pay and who pays for sewerage schemes is of vital importance to us at Okareka. Even with the 50% Government subsidy, we are faced with having to come up with something like \$20,000 per property for our scheme, a great deal more than at Mourea and Okawa Bay. The \$1,500 from general rates, I would like to raise the question - is that equitable? In terms of what we have heard about who should pay, I suggest that we are not the polluters to any great extent. A lot of the nutrients in the lake are historic and come from farmland rather than septic tanks anyway. I would question whether we are beneficiaries to any large degree. The majority of users of the lake would be from outside our immediate area, from Rotorua, from around the region, nationally and internationally. I think a case could be made for a much better contribution from Local and/or Regional Government towards the cost of these sewerage schemes. It is not likely to be affordable to a great many people, that sort of money. We are not all wealthy at Lake Okareka. I do not know if there is anybody here who can answer that question on behalf of the District Council, but I will leave it at that.

*Bryan Riesterer:* I will attempt to answer that and I understand that Okareka has its own catchment. In other words if Okareka did not take their sewerage out of the catchment, then whatever comes out of the septic tanks in Okareka will go into their lake. Maybe those people in Okareka want that – fine – leave them to it. I think that the interesting issue which Mayor Kevin Winters talked about was about piping the effluent over the hill, and so the people in Rotorua and Rotoiti catchments are now expected to accommodate the nitrates and phosphates from the Okareka catchment in their catchment, because they are shifted over the hill. Now is that fair? I do not know.

But if you want to deal with the lakes on a holistic basis, then you really need to consider all of these issues jointly. One of the big issues that the Regional Council addressed, I will discuss in terms of rating because it makes you understand the issue. When we looked at the three separate levels in rural rating, one of the big issues was whether the dairy farm at Rerewhakaaitu should pay the same as the dairy farm in the Rotorua catchment? We know from the science of Rerewhakaaitu that a third of their water goes to Rotomahana, a third of their water goes to the lake and the other third goes over into the river. We also know that the dairy farm in the Rotorua catchment, all of their water goes to Rotorua. So should we only charge the Rerewhakaaitu farmer a third of that effect or should we have done what we did and said, on the advice from some serious discussion with our Rotorua people, we should put it all together?

That is what we did, but we really need to do a lot more work on the economics, a bit of science, but also in look at what land use is actually occurring within the catchment before we can get any sort of rating drivers out of it. To the gentleman from Okareka, you know maybe you can alter your income figure, but you chose to live in that lake catchment. It is going to cost you maybe \$20,000 to get the pipe over the hill; maybe the ongoing costs should in fact be that you pay some other in the Rotorua District because your effluent is going into their catchment. That I hope will cause some arguments – please get up and argue the point.

*Ian McLean:* Well I hope we do not get into the argument of the question of the optimum scheme for Okareka and going over the hill or not because, quite seriously, that was worked through very solidly at Okareka by the Okareka people and with Environment Bay of Plenty and it was accepted as the best solution quite overwhelmingly by the people there.

*John Roper, Okareka resident:* I will respond to that as another Okareka resident. My understanding is that we were all contributors as Rotorua ratepayers to the Rotorua Sewerage Scheme. This was pretty hotly debated at the time and we were actually very happy to be able to join in with Rotorua, having paid some of the costs of that scheme. We would point out, without getting into another whole argument, the contribution of rates to the region from our little catchment, but I do not really want to go into those issues because I think it is a bit of a distraction today.

*John Green, LWQS:* This question can be directed either to Steve or John Cronin. There are two parts to it: The first one is that I understand the budget for the Ohau Channel wall is approximately \$15 million – maybe we can get that confirmed or not by Paul. The Central Government has put in \$4,000,000. Is it the intention of EBOP to now apply to the Government for 50% of the cost of that wall? That's my first question.

The second question is, and I think John Cronin can answer this better, that it's my understanding that a wall costing \$15 million will be depreciated in EBOP's accounts over the useful life of that asset. That \$15 million – let's say the Government pays \$7.5 million, it should only cost \$7.5 million to EBOP and therefore, EBOP should only depreciate \$7.5 million of it which then goes into our rates. But I am told that the accounting policy of EBOP is to capitalise \$15 million and \$15 million of it goes into the rates; in which case the wall gets paid for 100% by us over time through rates and 50% by the Central Government. Could John Cronin please comment on that?

*John Cronin, Chair, EBOP:* Commenting on the first one, of the cost of the wall and the 50% contribution from Central Government, it was the intention for Central Government to come up to the other half. Commenting on the funding of depreciation, I will just have to check with our own finance people, but we have a policy of fully funded depreciation and whether it is a policy of 50% fully funded or whether it is 100%. I would have to come back to you to answer that to be certain, John. But remember that when you are talking about depreciation and you are talking about the asset over the life of the asset, you are not talking about it on an annual basis, you are only talking about a pure fraction, so that might be 1/20 or 1/40 or 1/50 depending on what that is.

*Councillor Bill Cleghorn, EBOP:* I have checked with our financial people, John, and it is 100% depreciation over the life of the asset, that's part of the Asset Management Plan and a requirement that we have to follow.

*John Green:* I just want everybody in this room to understand that the ratepayers will end up paying 100% of it and the Government has already paid 50% of it. So that wall will be paid for 1.5 times and I think that policy needs to be looked at and changed. I am aware of other Councils throughout the country who are clearly saying that where they believe Government funds are available for the replacement of the asset, then they have made an assumption that the Government funds will come in and therefore they are only 50% funded in rates.

*Ian McLean:* Well John, maybe you have found why Environment Bay of Plenty got rich.

*Peter McKinlay:* There is provision in the current Local Government Act that allows the Council, if it deems it appropriate to do so, to decide not to fully fund its operating expenses from its operating revenue and so if there seemed to be an anomaly around the depreciation issues, EBOP would have the power to correct that anomaly by deciding to not fully fund its operating expenses by the amount it felt it would otherwise be over-recovering.

*Steve Chadwick:* I can give the assurance that Paul Dell has been to the Minister and has gone out to assure him that the costs are ever increasing and that Government needs to consider the extra cost from the original application and the 50% contribution, and we are looking at it. I must say also when I saw (and I think it was 2007/2008 or it might have been 08/09) a request in the spreadsheet for \$12 million – I did say then I bet that will not be \$12 million by the time there is a fixed case to come to Government to consider; and that is the sort of flexibility that we need here when you are thinking of 10 years out.

*John Cronin:* Just to briefly comment on that funded depreciation, as Bill correctly pointed out to us our policy has been 100% funded depreciation over time. It's from Environment Bay of Plenty, we don't have a lot of people wanting to give us money to help us to pay for any assets, so we are not used to it, but we will check it.

*Rowland Burdon, Royal Society of New Zealand:* We have heard about the great advances that have been made in the science but I do not think that should be allowed to leave people with the impression that the science has been all wrapped up. Getting the science right in greater detail is going to be an ongoing process. To pitch into taking action without adequate science knowledge can be a recipe for expensive and sometimes downright counter-productive fiascos. However as the science progresses you can often get to the point where you know you can take some reasonably effective measures; they might not be the most cost-effective as at the time but if you implement them, the time you gain may be well worth it compared with waiting until you have got all the information in. I speak from experience on this matter with the breeding programme with *Pinus Radiata* in New Zealand. A decision was made to pitch in with considerable gaps in the knowledge; some of the suppositions that the decisions were based on were not actually correct, but in hindsight it turned out that making the move and commitment to the breeding programme was well worth it, without waiting for the final details.

Now the state of scientific knowledge is clearly important in deciding when something should be done and what should be done, but I think there is another aspect that has emerged here that the state of scientific knowledge can be very important in settling the questions of how the costs should be allocated. I suspect it may be more of a limiting factor in that respect than in deciding what should be done and when; and I would like to know if there is any response to that proposition.

*Marion Robinson, Fraser Basin Council:* To support what you just said, our experience has been thus; that science is important and ongoing, but at the same time common sense dictates what I call the 'low hanging fruit' and if you can pick that low hanging fruit and go on with some small successes, they encourage people to see that there is a way forward. Having seen your slides where it showed that one third is human impacts and one third agriculture and

others - within each of those sectors there are some things that can begin to happen and success breeds more success and science is ongoing. So I simply encourage you to not get caught up in waiting, start doing something and feel good about those actions.

*Brian Bell, Nimmo Bell:* Mr Chairman, outside the meeting I was asked whether it is important to actually put a value on the lakes and this symposium has been about at what value. We have not got an answer to that yet, we have a high level estimate based on Costanza's work, but how much credibility will that have with Treasury? Not very much I would suspect. All through my career I have been working on valuation of productive agriculture and apply cost benefit analysis about things that end up being exported. It is very clear to me that the emphasis now is shifting to our natural biodiversity. The first point is that once society reaches a certain level of wealth, additional dollar of income may not be so important as the sort of society we live in, its cohesiveness, how well we get on with our neighbour and also the sort of environment we live in. As we use more and more land for productive purposes, the rest of our land that we do not use attains a higher value.

I have been in the situation of fronting up to Treasury with cost benefit analysis; generally 95% of the effort has gone into the productive side of the costing benefits and the other 5% is two paragraphs at the end describing the social and environmental values that should be taken into account. I think all that is going to change and I think that the value here is important. We will have to convince Treasury that they support a particular proposal to spend money that will not result in more dollars in the pockets of people, but will increase their welfare or the utility because of the experiences of all the things that Pam Kaval pointed out are important. I should declare a conflict of interest because we are in the business of doing that sort of thing, so I acknowledge that – but if you are to get funding then you have to put up a very convincing case. The sort of tools we talked about earlier in the symposium can provide the sort of evidence that will convince people who have to make very hard decisions on allocating resources. We have not got an answer to what value but I think it is work that should be done. Thank you.

*Ian McLean, LWQS (Session Chair):* Thank you Brian and thank you for the contribution you made. The one thing about going to the Treasury of course is that even if you give them a figure which is not just plucked out of the air but has some basis, when they look at it to say it is wrong – at that moment their mind has turned to what is the right figure, so it has some utility, the process of development.

*Peter McKinlay, McKinlay Douglas Ltd:* Just a cautionary note – the question of valuing the lakes is an interesting one from a number of perspectives and I am thinking within a policy context. The issue that one automatically runs into when a value is placed on something is the question of value to whom? I have heard a figure of \$100 million per annum and that essentially is valuing environmental services. The question is environmental services are a public good but for whom are they most significantly a public good? Are environmental services generated by the lakes here primarily a public good for New Zealand as a whole or for the District? I would think very carefully before using the numbers argument because it is not beyond the capability of the Treasury for you to be told if it is worth \$100 million a year and it is only going to cost \$100 million total to remediate it, clearly the local people could afford it because look at the benefits for them. Be very, very careful about using arguments that put huge numbers up in terms of value that can be turned against you. If you were really

attracted to using the environmental services argument, I would start using it after the practice of valuing environmental services had come into general use across New Zealand; perhaps as part of an environmental wellbeing component of the Local Government Act. I would not want to be a pioneer on this one for fear of the risk that it could be said, “you can afford to fix it for the value you will get”.

*Robin Sinclair, LWQS:* I would just like to look at the three statements that were made in the Symposium title, “Wonderful Lakes” – I think we are all here because we know they are wonderful lakes and we most probably either live near them or on the margin. “What Value” has certainly been covered very well and “Who Pays” has been identified in all the arguments that have gone forward and the information that we have. We see three recipients of that, Environment Bay of Plenty, the Government and Rotorua District Council. But if we actually studied what was put in the information, we saw there were polluters and beneficiaries, and I am wondering whether or not we are missing a link there. Should we not identify who pays, because if we spread that particular term out, it is not restricted to those particular bodies, it is actually a broader base. We would be missing something if we did not actually put some sort of formula in place to identify who pays. In other words, we need to actually set the formula on a basis that is efficient and transparent and I would say that we need to take two things; who is to blame and who is going to gain? In both of those particular cases there is an element of responsibility for what goes on. I would not say that we should use this as a battering ram but we need to broaden our base out to who is identified in that particular system of who pays, so we should at this stage not lose the plot but expand and identify it.

*Nick Miller, LWQS:* I originally just had one issue to raise but Rowland Burdon's comments brought another one to mind which I will very quickly pass over. The whole question of scientific research and the continuing need for it is a very important matter. I was a bit concerned in one of the financial schedules that we were shown in yesterday's presentation from Environment Bay of Plenty to see that the figure that apparently was to be spent on research into the matter seemed to be falling off after a little while and to a point where it seemed to be about half of the present level. I hope that decision is not set in stone because we might very conceivably need more.

The other comment is that in my opinion the establishment of the Chair in Lakes Management & Restoration at Waikato University has been a godsend to us in our current situation and I understand that position was originally established for an initial term of five years. That five-year term must be trundling towards its end. I hope that active consideration is being given to continuing the maintenance of that position, because I think it is very, very valuable. That is the first matter I wanted to raise.

The second is, and only one speaker, Sally Brock, has mentioned this and only to the extent of one sentence. It really boils down to the fact that we seem to be coming to the point where the beneficiaries may be asked to pay and I think in that scenario we need to consider looking at the value of the lakes as a source of water supply. There are two aspects to that; one is that for many decades, residential units around our lakes have relied on the lakes for water supply, often in earlier years as their entire water supply. Many of us, and I speak from experience here as a resident out at Lake Rotoiti, in the last three to five years have had to make drastic alterations at considerable expense to change our source of water supply in that the lake that we have been relying on is no longer suitable or safe.

When we see health warnings issued saying “avoid all recreational contact with Lake Rotoiti”, one does not feel quite so happy about showering or washing one's clothes in the water. I would like to make this point to those of you who feel that we have been perhaps unduly vocal about the whole situation. Those of you who do not like the idea of possibly having to dip into your own pockets in the future, some of us have already done so.

The third point is about beneficiaries and who should be paying. The Kaituna River has already been mentioned a little while ago in another context. Down at the bottom end of the Kaituna River and just slightly to the west of its mouth is Tauranga. There is a proposal for Tauranga to add something like 20,000 to 30,000 new residents, mostly in the vicinity of Papamoa and to the east of Papamoa. If you drive into Tauranga at this time of the year, you will see large signs basically asking you to go easy on water consumption, because now Tauranga appears to suffer with chronic water shortages. They do not have many large sources of water down there. I can just envisage in the not too distant future a scenario in which those 20,000-30,000 new residents are going to be looking to the most obvious large source of water in their vicinity, which is the Kaituna River and substantially supplied by Lakes Rotorua and Rotoiti.

We already have the situation in the case of the Waikato River which is currently experiencing cyanobacterial blooms and inconveniencing the people of Hamilton. In the past they have complained about odours in their water supply and gone to considerable expense to rectify that. Auckland is in a similar situation, they also draw on the Waikato River. I think when we start to look around for beneficiaries, we should not forget the large and relatively wealthy metropolis virtually to our north which one day quite soon might be requiring our contaminated waters. I suggest that it is very much in their interests to support all endeavours, with money, that look towards fixing the sources of their possible future water supply. Thank you.

*Councillor Kevin Marsh, Weston Bay of Plenty:* Just to reply to you about the water supply for Tauranga, they have already got it – it is coming out of the Waiari Stream which is just beside Te Puke. Te Puke has got an easement on at the moment that the Tauranga District Council are taking water out of there, so it will not be coming out of the Kaituna. I would love them to take it out of the Kaituna but they are not, and Waiari will do the whole of the Tauranga area.

*Marcus Wilkins – Farmer & Lake Resident:* While I have been here for two days I have learnt a lot about sewerage, I have learnt a lot about percentages and costs and everything, but we have not really dealt with the “what are we going to do” and “how are we going to stop the source of this pollution of our lakes”. We have got the bed of Lake Rotorua, we have got the geo-thermal side, we have got the septic tanks, and a lot of money has been spent on the sewerage. But let me remind you that as a farmer, and I know Mr Gifford has given a very good talk today and said that we are prepared to play our part, but in the pipeline now is probably up to 500-1000% more nitrogen going into your underground water because of the use of nitrogen in the last decade. We are using a tremendous amount of nitrogen and we have got to address this problem somehow and we will need support to do that. That is what I thought we would have been addressing, the source of pollution of the lakes from the various areas, not only farming, but all areas. Thank you.



*John Cronin, Chair, EBOP:* In response to the question on funding the Chair of Lakes Studies at Waikato University. It is in our LTCCP and unless someone comes in to tell us to take it out it will stay there. It is in there to be funded in the next period.

*Ian McLean:* Can I urge you all to write a letter in support of the plan and particularly this item in it.

*Don Atkinson, LWQS:* I would like to put on public record my disappointment that Rotorua District Council have not in actual fact seen fit to participate in this public forum. I think that it has been a grave misjudgement on their part and we and they both could have gained significantly from it.

*Richard Wilson, Rotorua:* Hopefully on behalf of everyone here, I would just like to thank the Lakes Water Quality Society and the Royal Society of New Zealand, Rotorua Branch, Ian McLean, yourself, Brentleigh Bond, John and Ann Green, Liz and Nick Miller and all the committee. Thank you very much for putting on this symposium – you did a great job and I hope you do many more and many thanks to all of you.

## Symposium Summary

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### TRANSCRIPT

Well it is just before 4 o'clock and criminal lawyers always try to avoid addressing juries at this time. We call it the 'soporific zone.' It is a time when juries have an uncanny ability to fall asleep. And prosecutors try to circumvent the process in such a way that defence counsel find themselves addressing at 4 o'clock. The defence do it the other way and unfortunately just last week I found myself on the wrong side of that particular tactic. I was addressing the jury at 4 o'clock in the afternoon when I noticed in the back row three from the left one of the jurors had fallen completely asleep. It is a very difficult situation – do you drop a book heavily, do you clear your throat, what do you do? So in the end I turned to His Honour and I said "Your Honour, one of the jury has fallen asleep there in the back, third from the left." He said "Mr Moore, you put him to sleep, you wake him up!"

I propose in this address, which I hope will be mercifully short, to touch on what seem to have been three themes which have emerged in the course of the discussions over the last two days and they, so it seems to me anyway, are these:

- First, this is not a new problem but it needs new thinking to solve it;
- Secondly, the economic value of our lakes and who pays?
- And finally how do we engage with central Government?

So dealing with that first theme, it is an old problem but it needs new thinking to solve it. We started off with that wonderfully evocative address of Don Stafford's where he talked about the very first changes in our eco-system, the introduction of carp and then brook trout and then brown trout and the incremental changes in the ecology of the lakes. And that colourful account he gave us of Elsdon Best who accompanied a fishing trip to Hamurana and the haul of about a ton of native fish. And then how those introduced species decimated the vulnerable native populations. That wasn't at first blush thought to be a particularly bad thing because where they had gone, in their place came some other and very productive species. And that has a natural parallel with where we find ourselves today because it did not seem a very bad idea in the 1950s, 60s, 70s and 80s to be increasing stock and to be putting on extra nutrients to increase and sustain the land's capacity for output.

Then he told us about the remarkable clumsiness which characterised so much and continues to characterise so much of this story and the inelegant intrusion of the authorities, the decades of negotiation and litigation in relation to the lake beds and the fact that this litigation went on so long because the Crown had deep pockets and it may well have been a strategy employed by the Crown to draw it out. I can add on behalf of all lawyers – we love clients like that.

But you may think he did finally capture when he concluded “the Government played a rum hand in their dealings with the lakes.”

Then on the theme of “it’s not a new problem”, we heard from Professor David Hamilton. I have to confess this is the first time I have heard David speak. I have not been to other symposia, and it was a wonderfully powerful address. His theme was trends and how we can plot those trends. He spoke about depletion trends. It is a truism that a trend is necessarily not a new problem and he talked about the four trends and the consistent set of behaviours which permit the forecasting of events because lakes act in a non-linear fashion to pressures. He showed us these “tipping points” and it seems that science and the aetiology of the problems that we have got are now reasonably well understood. I accept the well-made caveat that it is by no means complete but understanding the science is critically important we all agree. Again, it emerged from this Symposium that we must understand the underlying science.

That was a point which Rick Vallance put so powerfully and so persuasively when he was talking about solutions predicated on a sound understanding of the underlying causes; the reasons for them - because until you understand that, how can anyone have a sensible discussion about the strategy for clean-up and control and the costs involved. So going back to the theme, it is an old problem but it needs new thinking.

This model was also forcefully introduced by Dr Morgan Williams, Parliamentary Commissioner for the Environment; and his quote from Einstein (with some necessary modification), “the kind of thinking that has got us into this mess is not the kind of thinking which will get us out.” He emphasised that this was a long-term project (which we all know), and that new thinking was required. There is a need for resilience in the way in which we approach the problem, particularly with land use and the use of trees and wetland. He spoke of the limits to nutrient capacity and that the responsibility needs to be shared. He touched on this question of social equity, which is something I will return to in a moment. He spoke about robust community-based efforts which need to be maintained for decades, and that the state of our lakes is not a local problem, it is a national problem and in fact it is a problem that needs to be viewed in a global context – and that is the new thinking.

The global nature of the issue was emphasised by our overseas speakers and it is very reassuring, I think for all of us, that the sorts of problems which when they first occurred and we first saw our lakes, particularly Rotoiti, Rotoehu, turning green and having health warnings over them, there was a real concern – I do not know if you felt it – about where on earth we would turn. This problem seemed so massive, so incapable of quantification and yet it is also so reassuring to know that in other parts of the world everything that we are experiencing has been encountered elsewhere before and we do not have to reinvent the wheel.

But there is a body of new thinking and it requires us to examine the issues in a novel way. Marion Robinson’s Canadian experience on the Fraser Basin Council was a terrific paper. Again, so many of the themes that emerged in Marion’s paper, particularly the question of engagement (which is something that I will touch on later as well), is critical in terms of our approach in dealing with those who are involved in the funding and the need for collaborative leadership and the ability to inspire and energise collaboration and consensus-based solutions.

That is a theme which weaves into the third point. Rod McInnes's paper this morning gave us the New South Wales experience and the four models which he examined drew on the distinction between "legacy pollution" and "ongoing contamination", which was something again which emerged and thus characterised this Symposium.

So turning to the second issue, that is assessing the value of our lakes and who pays. The first to speak on this was Professor Robert Costanza from Vermont via live video link. It was a remarkable address. Thank God for technology. His vision of the world as an anthrosphere, the problem-solving through an integrated approach and how do we value our eco-system with the question, what is your goal? - viewed under the three heads of efficiency, fairness and sustainability. He certainly believed that you could attribute a monetary value to these assets and he referred us to the 1997 article in *Nature* where he did put, in fact, an actual dollar value on various components of the ecosystem and which, when translated to Rotorua alone, arrive at an astronomical figure of \$100,000,000 per annum.

Don't forget, Peter McKinlay's caveat "what does a figure like that mean?" There is a cautionary tale in all of this; there is a two-edged sword to that kind of valuation. Probably when you think about it, it is a meaningless figure other than an indication that this is a resource well worth preserving. There was also the intriguing comment made by Peter McKinlay in his presentation when he listed the value of the lakes and he talked about the tourist use and the very interesting disclosure that enquiries with local tourist operators reveal their view that the lakes are not central to the region's attractiveness as far a tourist destination. Against that we need to weigh up Lindsay Brighthouse's comment from the floor that 80% of the boats on the Rotorua lakes come from out of the region, which you might think is the kind of statistic which could be useful in terms of persuading Government of the value of this area.

Another important aspect referred to by Peter on the question of valuation, is the clean and green image of New Zealand, and that too, you might think, is likely to have a real resonance in Wellington and with the tourist industry. Because, by analogy, you only have to think about the consequences of a Swedish tourist being bashed up in Queen Street to the tourist operator who is targeting the Swedish tourist industry. If that gets onto the front page of a newspaper in Stockholm, what are the adverse consequences? What we have got, if you translate that kind of model to where we are now, are large tracts of water slap bang in the middle of the most populated island in this country. Waterways which can not be swum in; waterways which can not be enjoyed; eyesores in a very conspicuous tourist setting. How can anyone assert that that is not a compelling argument supporting the value of our lakes when assessed at a national level?

Then we had the fascinating distinction and debate between "legacy pollution" and "ongoing contamination". What has emerged so clearly over the last two days, you might think, is that there are two quite distinct forms of pollution which call for quite different responses on the question of who pays. On the question of ongoing pollution, using the polluter pays model, adopted and described by Dr Dan Marsh, the incentive approach versus the regulatory approach, the need to identify the least cost because some pollutants are easier to manage than others. We got onto this fascinating debate, which I suspect is probably more practical ultimately than it is theoretical, on nutrient trading. One of the economic models promoted by Professor Costanza was also discussed by Dr Marsh, and it has some real attractions. This

notion of nutrient trading has worked overseas and it has also worked in this country, albeit in a different industry.

The quota management system for our fisheries was designed to overcome the difficulties that those who were trying to regulate the industry confronted. Every time they brought in a new regulation to control fish nets or the size of fishing boats, the industry reinvented itself, adapted itself and came out with some kind of innovation which in a practical sense circumvented the purpose of the regulation. So it was necessary, fifteen or so years ago, to undertake a complete rethink about the way in which we manage that resource. MAF developed a notion of sustainability by calculating a total allowable catch. They used a scientifically-based model to work out what quotas individuals should have. Those quotas, as we all know, can be sold and can be traded.

The approach advocated by Rick Vallance is different again. What he said in a persuasive way is the need to be able to consider different innovative uses for those who are engaged in elements of pollution. He gave us some examples, particularly in the farming context, and reminded us that farmers are nothing if not innovative. We all know we enjoy an international reputation for this which goes beyond the invention of the electric fence. What he said we need to do is to persuade local bodies to adapt to innovation by encouraging and accommodating innovation by changes in district and regional plans.

So to summarise that issue, there does seem to be a consensus that nutrients entering the ecosystem now are manageable; we know the science; we know the causes; we know the solutions – whether we can incentivise or regulate, that is a debate that we can have later.

It is very interesting, it is challenging, but perhaps the greatest challenge that has emerged over the last two days is how we deal with legacy pollution; and the consensus is that is the real challenge which confronts us in the medium to longer term. How do we pay for the removal and the treatment of nutrient sludge, the treating and removal of inflows of nutrient-rich water which we know is decades old and which is an artefact of decades of intensive farming? If we apply the polluter pays test it is a model which fits much less comfortably.

The other aspect about legacy pollution is that the polluters have mostly gone. When the nutrients first entered the ecosystem all those years ago, the polluters were aided and abetted by a vibrant and growing primary economy - where there were fertiliser incentives, livestock incentive schemes, intensification - and the economy grew. The economy flourished, farming flourished, people made lots of money, we paid lots of taxes and we were all beneficiaries at a national level. If we apply a social equity test, a fairness test or natural justice, it is not hard to understand the role and responsibility of central Government. It was reassuring that those who have spoken for central Government – Steve Chadwick and Barry Carbon (on behalf of the Ministry) appear to understand this and have made a commitment to support us.

So turning to the third and final point, how do we engage with central Government? First, we need to understand the role of central Government and what buttons to push. Wellington is a very different place from anywhere in New Zealand - we need to understand it and we need to know what makes it tick. It has a national perspective. It is accountable to the whole country and tests that mandate every three years. We need to understand that. Ian McLean asked the question “Has there been enough engagement?” John Cronin says “Yes we are engaged.”

Steve Chadwick says “Yes it’s great but we can improve.” So there is room for higher and more intensive engagement with central Government. But what we need to know as a body is what does central Government need to know – What are central Government’s needs; what are their expectations; what are their perceptions? That is the message we got early on from Professor Costanza’s and Marion Robinson’s papers. There is this concept of cooperative engagement.

Barry Carbon told us the three things we need to consider before going cap in hand to Wellington:

- Don’t come and expect a favourable reception unless you are able to justify or substantiate what it is that you want. Well that is pretty reasonable. You expect that any time you seek funds from any organisation.
- Secondly, at a district or regional level, is the body that is coming to us cap in hand pulling its own weight? In other words what are the strategies that they in terms of self-help have already put in place? And again, that is hardly an unreasonable request. If they want us to help them what have they done to help themselves?
- Thirdly, this is much more practical, prosaic – give Government notice, pick your time and oh, for the days of government surpluses.

You might wish to add a fourth which inferentially emerged as part of this discussion and came out late this afternoon from Peter, and that is:

- Know your case. Do not get your case wrong, do not plead a case which is factually unreliable, know your facts. Your credibility is essential.

If you are going to Wellington you must know the A B & Cs. You must know how to answer the tough questions. Your answers must be empirical and they must be capable of being tested and proved. If you do not do that you lose the credit and the very substantial credit which you have worked so long over the last few years to build.

The other interesting thing and which emerged is that through engagement, you also to learn what central Government’s perceptions and prejudices are. Barry Carbon candidly informed us that the perception in Government is that EBOP is wealthy, the inference being: if they are wealthy then they can make a greater contribution. That comment, as we know, drew a vociferous reaction from EBOP representatives. “Not true” they cried!. Well if it is not true, and for the purpose of this discussion it probably does not matter whether it is or not, at least we know what central Government thinks. Information and knowledge is our most valuable tool. It may not always be good news; it may not always be correct but in terms of the strategy and the armoury that we need to assemble for this campaign, it is absolutely invaluable.

Finally I must record certain acknowledgements. Some have been made already but we must acknowledge the work undertaken by the LakesWater Quality Society, the Royal Society and the others who have so generously supported this worthwhile initiative.

I do want to return momentarily to the LWQS. What has been achieved by that tiny nucleus of individuals is utterly extraordinary on any scale and so much of the credit for what has

happened over the last three or four years must be laid at their feet. This very small group, fuelled by the infectious enthusiasm of Ian (McLean), who has come here all the way from Bucharest, and ably supported by a handful of focused, industrious and insightful individuals, now under the stewardship of John Green. We are lucky indeed. If this is a global problem (and we are told it is), then it certainly shows us how a small committed group of people can change the world. We are most fortunate. Go well.