NATIONAL CONFERENCE OF PARLIAMENTARY

PUBLIC WORKS AND ENVIRONMENT COMMITTEES

"WATER—ENGINEERING SOLUTIONS AND ENVIRONMENTAL CONSEQUENCES"

TRANSCRIPT OF PROCEEDINGS

House of Assembly Chamber,
Parliament House, Adelaide

Monday 30 September 2002 at 9 a.m.

OPENING AND WELCOME

MR PAUL CAICA (South Australia): I am the Presiding Member of the South Australian Public Works Committee. On behalf of Lyn Breuer, the Presiding Member of the Environment, Resources and Development Committee, and our respective committee members, I welcome you to South Australia and Adelaide for the 2002 National Conference of Public Works and Environment Committees.

The interests that public works and environment committees often share have resulted in our annual conferences being run back-to-back. This is my first attendance at one of these conferences. I understand that they used to each take a day and a half. This year, we are attempting to make this conference completely seamless, because we believe that the issue that we are covering crosses the boundaries of both committees. As our committee has selected water as the theme for the conference, it seemed absolute commonsense to make this a seamless conference.

Both committees are responsible to oversee government water related projects and issues. We share an awareness of the complexity and importance of water and the role that lawmakers and governments play in ensuring safe high-quality drinking water; in guaranteeing the water needed by farms, industries and communities to generate jobs and economic wellbeing for our society; in avoiding environmental damage through poor collection and disposal methods; and in protecting our citizens from the destructive potential of stormwater.

The short period available between the reconstitution of the committees after the South Australian election and the date of the conference made the organisation of the conference a difficult task. However, we are confident that the outcome is an exciting one. During the conference, members of academia, industry, government, private enterprise and the media will speak on broad strategic aspects of water and, importantly for us, the role that lawmakers can and must play. Tomorrow's site inspection will be a variation on what has happened at previous conferences. It will be a chance to see that communities can make important contributions that do not have multi-billion dollar price tags connected to them and that, even in tight economic times, worthwhile changes can be afforded.

We are also excited to be making a late addition to the conference program. Late changes to her filming arrangements mean that Ms Ticky Fullerton, former ABC reporter for *Landline*, will be a guest speaker at the conference dinner tomorrow night. For those who do not know, Ticky is the author of a wonderful book on water issues called *Watershed*, and she will be available to speak to delegates at tomorrow night's conference dinner. Ticky and her book are exceptionally well regarded by all in this country who have an interest in water, and we are delighted that she will be able to be here.

I trust that the next three days will be interesting and stimulating for each and every one of us. On that note, I invite Ms Vini Ciccarello, the member for Norwood and a member of our Public Works Committee, to introduce our first speaker.

WATER: THE NEED FOR SYSTEMS THINKING AND NEW PARADIGMS

MS VINI CICCARELLO (South Australia): Welcome everyone. It gives me great pleasure to introduce Dr Graham Harris, an eminent ecologist and freshwater and marine biologist. Dr Harris has an international reputation for work in aquatic and terrestrial ecology, freshwater biology, pollution monitoring, biological oceanography and remote sensing, and he has published more than 100 papers and four books. He has also done leading work in fisheries dynamics and the effects of climate variability.

Dr Harris was previously the Chief of the CSIRO's Division of Land and Water and the Head of The CSIRO's Environmental Projects Office. He was the leader of the CSIRO's Port Phillip Bay Environmental Study (which has since prompted similar indepth studies in Sydney and Adelaide) and the leader of the CSIRO's Coastal Zone Program, he was involved in the CSIRO's Blue-Green Algal Research Program, and he is an adjunct professor at the University of Adelaide. Dr Graham was born in the United Kingdom and graduated from the Imperial College London (Botany). He joined the CSIRO after a distinguished career as a biology professor in Canada. Welcome, Dr Harris.

DR GRAHAM HARRIS: Honourable members and ladies and gentlemen, thank you for giving me the honour of addressing you and for asking me back to Adelaide. As you would have heard from the introduction, for nearly five years I ran the Waite Institute here as part of my duties as the Chief of Land and Water, and for a number of years I practically lived here, so it is really nice to be back.

The topic that you have chosen for your conference is undoubtedly the most important issue that this country faces. Water is the lifeblood of this continent and it is really one of the keys to our future. How we manage it will determine our future path. It is already a limiting resource and it is a microcosm of a number of broader challenges facing this nation. The recently completed National Land and Water Resources Audit revealed that much of rural and regional Australia is, if you like, in the red and that 80 per cent of profit comes from less than 1 per cent of the area of this land. By and large, those are regions with water and irrigation systems. So, essentially, water is money. As you heard in the introduction, profitability, productivity and water are very much interrelated.

As Peter Raven pointed out in a speech last year, Australia is facing a number of environmental, social and economic challenges over the next 25 years. As the most arid inhabited continent we are facing many of these challenges before many other countries. This is both a threat and, for us, a real opportunity because improved water management is one of our fundamental challenges and it really could become a gift to the world if we get it right.

Over the last couple of years, the CSIRO has done a number of analyses of some of the next 25 years worth of challenges for this nation. That is really the basis of the flagship program for the CSIRO which I now run. We face an ageing population, increased shortages of liquid fuels, declining minerals and exports, water shortages, environmental decline and an ever increasing need for innovation and global competitiveness. We were once one of the richest nations in the world, based on very high value exports. We can do this again, but we will need to be creative and innovative, and we will need to maintain and increase our competitiveness in global competition. So, we face some choices about our future. We have some doors, if you like, which are open to us, and it is up to us which door we choose.

One Australian future is 'business as usual'; however, some of the federal ministers, including minister Truss, have said that 'business as usual' is probably not an option. The other future is probably much brighter in that it represents the future we would all prefer: an innovative and globally competitive nation engaged with and open to the world and exporting high-value goods and services. Many of those services could be based on successful restoration of the Australian landscape. For example, the environmental management industry is growing at twice the speed of the information technology industry at the moment. So, we must become competitive and sustainable. If we do this we can profit in both dollars and quality of life. Water is the key to a lot of these issues.

So, continued GDP growth and wealth generation are essential. Failure in this regard will make the future that we all aspire to unaffordable. If we want to fix salinity we have to be a wealthy nation to do so. When it comes right down to it, the basic parameters are: wealth creation and GDP growth, participation, productivity and sustainability—and I will come back to that theme as I go forward.

Participation rates will be very much a function of our ageing population. There is not a lot that we can do about it because it is a function of demography, and that is really set. However, as to productivity and sustainability, there are two fundamentals that we can do things about and they are water and energy. In both cases, we are going to need innovation and capital investment. I and many others have come to the conclusion that 'business as usual' is not really an option for us over the next 25 years. Incrementalism is no longer sufficient, and there is a real need for Australia to become a more creative and innovative country quite quickly. As someone pointed out last week, during the time that it takes me to give this talk, we will lose about 5½ hectares to salt. I think the rate is about 11 hectares an hour.

So, there is an urgent need for new ways of thinking, new paradigms and new horizons. One of the major problems that we face is that, whilst the concept of sustainability is well accepted, practical advances on the ground are proving quite difficult. The picture globally, certainly on the ground, is quite mixed. We can point to legal advances in western economies—the COAG reforms are fabulous examples of something that Australia has done

very well—but globally the trends are downwards and there are problems with turning the concept into action. So, we have to move beyond some of the present fascinations with market economics, resource depletion and unfettered capitalism. I am not saying that I am not a supporter of economic efficiency and market economics—I am.

It is just that, put simply, market economics are necessary but not sufficient. I think that the COAG reforms, again, are a splendid example of developments in resource trading, natural capital and markets for water, but there is more that we must do. If these reforms are to be successful they must be supported by other non-market mechanisms. For this reason, we have to lift the level of the debate and look at the entire environmental, social and economic system, the triple bottom line. Disruptive and transgressive creativity is essential. We need people with new and challenging bright ideas and we need new measures of sustainability and wealth.

We need some new paradigms, if you like, for water. We have been slowly increasing our water use efficiency but there is a real need now to make a quantum jump with new crops, new rotations and new urban designs. This is happening: there are some new developments both here and in Melbourne of suburbs and subdivisions with totally new infrastructure; but we need to bring these things forward. We need integrated regional solutions, and that is something that Melbourne is now seriously starting to consider.

Traditional economic practice is couched in the context of non-spatial and non-natural equilibria, but the more we discover about natural systems the more we realise that the ecosystems that sustain this landscape are dependent on and sustained by lots of temporal and spatial variability. We find this temporal and spatial variability annoying. We have flood, fire and storm. We are a land of droughts and flooding rains. So, what do we do? We regulate the rivers and waterways, and we put weirs everywhere to provide that security and certainty. But what that does is seriously interfere with and damage the natural processes of our landscape.

We need some research and we need some development and innovation to come up with sustainable systems, and we need production and manufacturing systems that reduce waste and deliver a high return on investment. We need new landscapes and land use patterns that sustain, and we need integrated and multidisciplinary solutions that are practical and profitable. As I said, wealth creation is important, but it has to be done sustainably. Believe me: despite many assertions to the contrary, most of these solutions do not presently exist. The Flagship programs that CSIRO has now founded are an attempt to deliver many of those necessary solutions.

What we have to do—and this includes the science community, I have to say—is to start thinking in a more inclusive and integrated way and try to balance complexity with

systems thinking and profit. This is not going to be easy. It is quite difficult to get people to think this way. Too many people focus on one aspect of the business or one aspect of the science, I have to say, or one small piece of the puzzle, and what we are trying to do is look at the landscape as an integrated unit and to balance the needs of the natural systems, the biodiversity, the productive landscapes and the wealth generation.

Water and energy prices are essentially at the core of this systems thinking. It is the water that links everything that goes on in that landscape. It is what flows down, through, under and across and links things, and it links our consumption and production processes right across, connecting rural regions to the ocean. So, we need to think about research, think about developing new sustainable solutions for farmers and irrigators, and for urban areas as well. Think of the eco-village development now going on in various cities.

The problems that we now face are too big for government alone. We actually need solutions that encompass both public and private benefit and public and private investment. We have to leverage cost compliance and provide much more sustainable and suitable incentives. We have to lift the level of the debate to consider the consequences of our actions in a broader light. We need new environmental ethics and, to quote John Ralston Saul, 'a sense of the other and of inclusive responsibility.' Ecosystems services are one area in which we are really starting to think of new ways of valuing the landscape and looking at the way in which nature does useful things for us.

For example, in New York City it has been proved to be cheaper, more effective and more sustainable for the city to actually buy forested catchments in the Catskills to provide clean drinking water than to take water from agricultural and urban catchments and then pay for extensive and expensive treatment technologies. Catchment protection is in fact more sustainable and cheaper. There is a general lack of knowledge of the importance of ecosystem services and the services that they provide to us, be they clean air, clean water, control of ground water levels or pollination of crops; a number of things.

Land clearing is a short-term, one-dimensional view of a very complex rural problem; that is, how to produce sustainable profit, how to nurture rural communities but also sustain the environment. The onset of dry land salinity which we have heard so much about and which is now a widespread problem is really a failure in the removal of the ecosystem services that were originally provided by the native bush of Australia. We have a very complex, very diverse and very fascinating series of interactions between the native plants, which control ground water levels and control salinity. When we remove that, those ecosystem services are removed.

A paper in the journal *Science* a few weeks ago concluded that natural ecosystems provide services that are actually worth double the total economic value of western-style

farming, aquaculture and fishing operations in the same locations. In fact, there is enormous value there that we need to work on and work with. Equally, Costanza and others in 1997 estimated that the total value of global ecosystem services was equivalent to the global GDP, a huge number of about $40 trillion. Generally, what we do is sacrifice natural capital, biodiversity, spatial and temporal variability, resilience and those ecosystem services for a much more planned and regulated spatial arrangement, reduced diversity and, of course, shorter-term profits.

But this is a short-term view, because reduced biodiversity leads to a reduction in security and profit in the longer term, and the total economic value is reduced. In fact, this is not necessary. What we are seeing around the world are more and more communities and companies rearranging their lives around what might be called restoration ecology or even ecological mimicry—restoring the landscape, putting back some of the diversity, reusing waste, recycling water, linking various functions—and they are finding that this is highly profitable. So, we need to value on actual capital, restore some of its natural variability and biodiversity, and plan for resilience.

The bulk of the growth of western economies in the first half of the twentieth century was probably unsustainable. There was a strong link then to research and innovation, and what we need now are new kinds of research and innovation to move us into a much more sustainable future. After all, all kinds of wastes and things are starting to gang up on us. It is the little residual flows that started to cause problems: the little bit of atmospheric carbon dioxide that escapes; the little bit of salt in the ground water that starts to move; and the nutrients and run-off in sewage. You have a nice example here with the sea grass loss just off the coast of Adelaide. All this is both inefficiency and waste.

We have about 1.1 billion people in the world at the moment without safe water supplies. Half the world's population, about 3 billion, is without sanitation and about 1.2 billion live in poverty. 80 per cent of preventable disease in developing countries comes from poor water supplies, and 30 000 people die daily from water-related illnesses. The recent Johannesburg summit made a commitment to address these issues.

To improve productivity and sustainability in the twenty-first century will require new creative technologies. Sustainability means that we put that system together and that we value our natural capital. Third world farmers get something like one-third of their income from what we might call free environmental goods: firewood, food, medicines and building materials; and, in fact, the landscape here provides a surprising amount of wealth for us in similar ways. As Amartya Sen has pointed out, globalisation is not inherently a bad thing. Indeed, it is an essential component of human development. The problem with the world is not, as some would assert, globalisation, but equality and inequality both between and within

nations. So, we have to tackle the problems of growth, inequality and resource access, particularly water.

How do we do this? What we have to do is think both from the top down and from the bottom up. There is a lot of bottom-up innovation going on at the moment. If we look at urban and rural communities, particularly in this country, there is an enormous amount of individual innovation, but is it going fast enough? Could we do more? Do we have the incentives and the other structures right?

So, we have to think of new paradigms. Water supplies are actually more than just reservoirs, pumps and pipes. We need to preserve catchments and consider the entire land use system—forestry practices, soil erosion, rainfall and climate change. The recent floods in Europe are a nice example of a link with a climate change induced pattern in the weather—more intense rainfall, development in the catchment and huge floods. We have a good example in Australia with that cryptosporidium outbreak in Sydney. We took our drinking water supplies for granted until that crypto outbreak reminded us just how dependent we are on the quality of our catchments and the ecosystem services they provide.

The present practice of storing huge volumes of water in large reservoirs, running it once through the cities and dumping it at sea, both must and will stop. First, the water is too valuable to waste and, secondly, we are damaging key terrestrial, aquatic and marine ecosystem services. There is a very nice example in Adelaide with the seagrass beds just offshore. Those seagrass beds are invaluable sites for nutrient removal in coastal waters. They do a huge amount of nitrogen removal for free. Once lost, they are almost impossible to replace and the ecosystem services then must be substituted for by very large and expensive treatment plants.

As a result of the developments occurring in Adelaide, in terms of the Adelaide coastal waters study (which I am pleased to be involved with), the recycling through Bolivar and the Virginia pipeline, Adelaide is leading the nation in looking at the whole system of water reuse and its coastal resources. Stormwater is in fact a resource. It is everyone's problem and no-one's responsibility, quite often, but in fact it is quite a valuable resource.

Irrigation is more than improvements in storage, drippers and spray irrigators. We must improve water use efficiency and sustainable practices must be adopted more widely. History tells us that long-term sustainability of irrigation areas is problematical. For example, Colleambally in 1980 could grow only short carrots. By 1995, a large groundwater mound was built up underneath. That is happening across most irrigation areas.

Some 70 per cent of the surface water we divert goes through agriculture and irrigation. We have sustainability problems plus degraded rivers because we pull out too much

water from rivers and we use rivers as irrigation channels. We ignore their intrinsic ecological requirements and the ecosystem services they provide. The result is ecological decline, loss of biodiversity, replacement of native fishes with fish such as carp, and more expensive water treatment plants and infrastructure.

The new paradigm is to think of the entire system, hill slope and headwater to ocean, with urban development in there. Sustainable regional development will require us to do this. We have to think about reuse, recycling, increased water use efficiency, patterned landscapes to conserve water and control salinity, reintroduction of environmental flows—and we are beginning to do all these things.

Then we can think of the next level, which is the interaction between water, energy, information flows, material flows and transport. The next level up, if you like, is the next level of industrial and urban ecology. There is a growing worldwide trend in this direction. I will cite an example from CSIRO's flagship programs.

In this country we have world-class supplies of mineral sands deposits in the western Murray basin. If we can find a way to cut in half the energy requirements of making Titanium metal we can build a world-class industry and create jobs based on those resources. We need new mineral development. The Titanium produced is a key component of desalination plants, with synergies to both solar and renewable energy supplies.

If we can get the bulk of the energy from renewable resources and cut down the cost, we can make the industry more sustainable. There is a further bonus because one of the key feedstocks for the production of Titanium is salty water rich in magnesium and chloride—and, by golly, we have plenty of that lying around in the landscape.

If we can pull it off, we can turn something which is in abundant supply and a problem into a resource and we can think of new sustainable industries and sustainable regional development opportunities to fix up some landscape problems at the same time. That is participation productivity and sustainability. It is one of the programs on which we are working.

I will give some examples from other programs. We are working on improved IT services, electronic health service delivery in rural areas, remote education delivery and decision support systems for farmers in order to improve both public health services and productivity and efficiency with scarce water in rural areas. We are trying to develop new, more profitable landscapes, conservation farming techniques, new landscape designs and conserve biodiversity and ecosystem function, use less water, sequester carbon and provide improved water quality. We are working on some new fertiliser development that comes from

recycled salty ground water. They increase production and they are more environmentally friendly. We are looking for triple bottom line wins.

I remind you that in the energy area there are increasing synergies between water and energy infrastructure as the energy becomes more distributed. Again, we want to make a paradigm leap from slow improvement in energy efficiency through traditional technologies to some totally new technologies capturing microturbine, solar enhanced fuels and, finally, hydrogen.

We also want to use the Titanium we can produce, not only in desalination, to produce lighter hybrid vehicles so we can dramatically improve the efficiency and reduce the CO_2 emissions from transportation vehicles. CSIRO has produced the e-Commodore—the hybrid Commodore car—in conjunction with Holden. In fact, its performance is so startling with its electromechanical drive train that it cannot be driven on the roads. If we can pull it off then we produce hybrid vehicles using Titanium, produced sustainably, to give ourselves greater export opportunities.

In all cases, we want to go to a landscape design which is more ecologically friendly and which has increased productivity and water use efficiency with improved resilience as a result of innovative technologies and greater efficiency. We want to reuse and recycle water and waste and the energy.

This is the so-called factor 4 or factor 8 initiative, which is now a worldwide movement. We want to halve waste and energy use and double water use efficiency and productivity. The challenge is for science managers such as me is that technology breakthroughs will come at the interfaces of established technologies and disciplines. For example, they will come through systems and, indeed, it is a challenge for us to put together the players.

There is institutional and individual challenge. We need new paradigms, security of the markets and certainty, but we need to do that in a landscape which we do not destroy at the same time. Instead of just quick profits and high shareholder value in the short run, we need growth with equity in the longer term but, in the year of drought, we need downturn with security as well.

Given the major impact of the drought on the GDP, we need to think about profit and resilience as measures which drought proof this land, as well make it productive. If we are going to build sustainable, creative and innovative communities, which are productive and profitable, then we need to think about not only market-based solutions but also non-market based solutions. Markets can only do so much.

The book *The Rise of the Creative Class* by Richard Florida shows how profitable and creative communities are built around all kinds of social, cultural and other incentives. Creative and innovative communities require underpinning infrastructure built around things such as education, architecture, art and town planning, and a host of non-market institutions.

He says they need three Ts—talent, technology and tolerance. Not surprisingly, these institutions, like regional universities, are absolutely critical to our future because they are the centres of culture and innovation and technological advance and they attract talented people. We need our regional universities, colleges and TAFE. If we are going to achieve factor 4 or factor 8, they are absolutely critical.

We must support research and development. It is not actually a cost but, rather, an investment in the future. Science must do its bit to prove we can make a difference. We have to be able to engage in an effective way with the guy sitting on a log in his salt patch. We need effective partnerships to do that, because science is only 10 per cent to 20 per cent of the solution. We need partnerships across jurisdictions, industry, commerce and the community if we are going to pull it off.

A more sustainable Australia (of which water is one of the absolutely critical components) that will improve productivity and resilience, increase water-use efficiency and energy efficiency will need national partnerships—a 'magic circle', if you like, of science, jurisdictions, government, industry, the community and, indeed, the media. Markets and resource trading are essential, but so are restoration of the biodiversity, the ecology and the ecosystems—services backed up by education and investment. We live in a world of increased interconnectedness. Globalisation and complexity have led to all sorts of surprises, which will require a degree of flexibility and adaptedness in our policy development.

I think that the foot and mouth outbreak in the United Kingdom should be a warning to us all. We must learn by doing and adapting as we go, and we must change. I think Nugget Coombes said that institutions were yesterday's solutions to last week's problems. We have too many examples of institutional resistance to change and too great a complexity. From CSIRO's perspective, we tried to make a map of all the people involved in the salinity problem in this country and we gave up when we reached that point. When one thinks about partnerships and trying to get some improved efficiency, the major challenge is an institutional one. We must try to push the debate forward.

It will be a major challenge for both individuals and institutions. Times like these are never comfortable and, at the moment, the CSIRO is going through a considerable change process. However, we can look around the world and see the countries that did not grasp the nettle, that did not take up the challenge, and we can see the alternative to continued change and reform. I think that there is a need for a multilateral forum to advance some of the policy

debate on water and energy in this country. We need to discuss options, explore alternatives and to work with the complexity of these kinds of networks. Science needs to better inform the policy process by telling us some of the fundamentals and introducing new ideas.

We need to invest more in the future, I think. Markets can solve many things but non-market incentives and creativity will determine whether we are successful. Mike Young is here today and, yesterday, on ABC's *Landline*, he made a very nice comment; he said that one of the problems is that we make it too cheap to do the wrong thing and too expensive to do the right thing. I think that we must start to think about the way in which we structure incentives to see whether we can turn this around. We need public and private partnerships and we must start thinking about innovative methods, such as water bonds and vehicles to attract private investment, and there is also a role for government to bring it forward.

One of the biggest challenges is the scale of the problem that we face. Recent estimates put the cost of restoring this continent at something like $65 billion, and tackling this task will require major investments in water and landscape infrastructure. It will require projects of unheralded scale and scope. We will need demonstration projects of the order of $30 million, $40 million a year, probably, and we need to assemble those from that network I just displayed. This project is something like 10 times bigger than we have been used to. The CSIRO's flagship programs are trying to build this type of national partnership to mobilise the constituents in the jurisdictions and to get the necessary resources together to make a real difference.

We are trying to put a 'Team Australia' approach to water and energy problems. We must build trust and collaboration across many communities, jurisdictions and institutions, and it will be a major challenge. We can put together major cross-jurisdictional partnerships but it will be a challenge. Can we do it? Can we conceive of operating on regional catchment scales and whole water cycles from hill slope to ocean, including the city? Can we conceive of putting those partnerships together, and can we solve the institutional inertia problem? Can we build the trust and the knowledge base? Can we give the people the tools?

Can we provide those practical and profitable solutions? I think that we can do this but it will be a major challenge. We already lead the world in water and resource trading and we lead the world in terms of the land care movement. I am saying that regional, integrated solutions are just the next step along the road for us—it is the next scale up and the next institutional challenge. We must push ahead with new kinds of markets and incentives for creative partnerships. We need to lift the level of the debate so that we start to think about whole systems reuse, recycling and water-use efficiency. We need a paradigm shift to increase dramatically the efficiency and effectiveness with which we use water.

We will need research, education, community involvement, policy settings, etc., to be right. Thinking back to the diagram of all the institutional relationships I displayed, perhaps one of the most important tasks is to get some critical analysis into that so that we can think about building the right partnerships and getting the right players. I say: courage one and all. I think we can do this. It will certainly be a better place when we leave it. The key aspect is to get people talking about the kinds of issues and solutions that we are going to need. We have a unique, fabulous and important global resource in this continent that we need to conserve, but we also need a productive and profitable nation, and that is the challenge.

It will need leadership, trust, reconciliation, creativity and innovation. We have done it before. We just need to raise our eyes and look at the bigger system to try to put the challenge together. We can make a difference. If we can pull it off, we will profit from our actions in many different ways. Thank you very much.

MS VINI CICCARELLO (South Australia): Thank you, Dr Harris. We are on a tight schedule but we have some time for questions. On behalf of the Chairperson of the South Australian parliament, I welcome the New Zealand delegates here for the first time. Welcome to you and, as our Chairperson has just indicated, your attendance will make it very interesting in determining the location of future conferences. If anyone would like to ask a question, for the ease of *Hansard*, would you please stand and identify yourself. Please make your questions fairly succinct so that we can give as many people as possible the opportunity to ask questions.

HON. DUNCAN KERR (Commonwealth): Dr Harris, you said that the cost of this project was extraordinarily large, but I just did a small 'back of the envelope' exercise and if the cost of restoration is $65 billion that still works out at only $6 500 per taxpayer. When one considers the scale of what I had conceptualised in my head as the problem it is still quite feasible in terms of economic parameters. Would you reflect on that?

DR GRAHAM HARRIS: There are two challenges and there are all sorts of discussions about environmental levies, and so on, and, indeed, individual communities are doing this. Wallis Lake, on the New South Wales coast, had that terrible oyster problem which caused hepatitis and a number of other issues. That community has, in fact, put a small rating levy on itself to pay for the ecosystem services to clean up the catchment. You are absolutely right, that if you were to look at innovative ways of raising some money it is possible to do that. The real challenge, though, is to get some focused investment. The bigger challenge is to know where to put the dough if we had it.

One thing we are trying to think through with our flagship program, which is code named 'Healthy Country', is to pick some regions to see where we can focus some investment because nothing succeeds like success. We want to be able to point to some real on-ground work.

HON. DUNCAN KERR (Commonwealth): As a follow-up question: one problem of market-based solutions that you advocate is that there is a huge resistance from those components of the system that, I suppose, free market economists would call free riders. The problem is that those free riders are farmers and well-established economic interests that we regard as part of our central political constituencies. I wonder whether, if you look at, say, the recommendations of the Productivity Commission in the full repairing lease and then look at how difficult it has been to impose restraints on cost recovery on water, an end to land clearing, full cost recovery and market-based solutions, do you have some reflection upon those issues?

DR GRAHAM HARRIS: You are probably asking the wrong person. There is Professor Young sitting at the back there, who I think is going to talk to you about this, I think maybe later today. We clearly need to move on from where we are now and to take that sort of systems view, and that means getting the tax and the incentives and all the other structures, the property ownership, all that together. We have really got to bring in to the cost of what we do those externals, because you are absolutely right. It is 'The Tragedy of the Commons', as Garrett Hardin called it. It is always better to be the guy that is still creating the salt for your neighbour. I think of the examples of what is going on in Western Australia at the moment, where people are draining their wheat properties, and the drains just stop at their boundary. So you have a more productive and profitable enterprise but the guy next door is getting flooded out with your salt water. So that is where you have to start thinking of the regional solutions and you have to put the planning, the policy and the infrastructure, and so on, over the top of it.

So I think there is a real need to get the market to operate in a broader context, and that has proved to be a real challenge. Maybe Mike has got some real solutions which he will talk to you about later in the day, but I know he has been thinking about that issue of how do you operate that market whilst bringing in the costs of the externalities and those other regional sorts of issues. It is the core of the issue.

MR BERNIE MASTERS (Western Australia): Graham, in Western Australia there are something like 17 levels or layers between the farmer on the ground and the federal Minister for the Environment, and that creates enormous communication and other problems. Is CSIRO giving any thought to how you reduce those number of layers and get those two ends of the spectrum closer together?

DR GRAHAM HARRIS: We have given a lot of thought to it but I do not think we have got any solutions. Part of the problem is that as scientists we have to be reasonably careful when we deal with jurisdictions, in various ways. But it is absolutely true that in a way we have designed the continent in the days of sailing ships almost, if you like, and we are all awfully good in this country, I think throughout the western world, at setting up new institutions when we have a problem but we are not terribly good at getting rid of them. Some

degree of levelling and simplification is going to be essential if we are going to tackle some of these issues. But how we go about doing that with all the jurisdictional and institutional issues I have no idea.

HON. MIKE ELLIOTT (South Australia): One of the concerns I have is that we as politicians tend to react to what we can see rather than what is coming. I was wondering if you could reflect on that, firstly not only in terms of the level of salinisation we now see, for instance, but the level of salinisation we will end up with if we do not act, and, secondly, there is the issue of greenhouse, which you touched on briefly. If we start designing engineering solutions and other solutions for things as they are we may not be doing what we should be doing.

DR GRAHAM HARRIS: There is no question that salinity is a major issue going forward. As I said, the last figure I heard was 11 hectares an hour or something. There is no question that we are going to end up losing a large area. The audit predicts that we are going to lose an area of land about equivalent to the state of Victoria if we go on doing what we are doing, in about 50 years time. So what we have got to do is to go to more sustainable landscapes, and that means putting some of the biodiversity back, but we have also got to find a way of productively farming it whilst taking up some of the area with more diverse systems that constrain the groundwater.

I was watching *Landline* yesterday, and there are some individual farmers starting to do this. There is some real innovation and real practical learning being done at the level of individual properties. What we have to do now is to take it to the next level up and see how you can build that into a regional system that is a solution. It is different in the east from the west. In the east there is enough relief that you can do it with some of the native vegetation, but I think in the west it is going to require drainage, and that is coming out in the solutions.

In terms of greenhouse, I think there are two inevitable trends. One is whether there is an effect of $C0_2$ on the climate or not. You cannot go on putting a radiatively active gas into the atmosphere forever and not have anything happen. Secondly, there is I think a rapidly growing global trend to trading regimes, and I think you will see even in this country that some of the big industry will start pressuring the government now to get involved in trading schemes. Using the technologies that we have available to us now in CSIRO we can conceive of making Kyoto irrelevant. Let us just put that debate behind us and move on. We can in fact dramatically reduce the $C0_2$ emissions in this country, with the technologies we presently have available. It is really getting the incentives and the costs and pricing structures right to get them deployed across the landscape.

So I think the trends will be, firstly, if we go down the track of increasing efficiency, and that is an essential from a precautionary principle point of view. Secondly, I think you will

see, whether we have a Kyoto framework or not, some push towards a carbon trading regime, because it is going to arise globally, and I think you will see major Australian corporations wanting to get into that both nationally and globally. I think we should just sort of move on from where we are now, quite honestly.

MR BRUCE BILLSON (Commonwealth): Dr Harris, firstly, you talked about a magic circle involving the media, and I wonder whether that reflects some of our own learnings that there is an awareness that something needs to be done but there seems to be a preparedness to look to someone else to do it, and the question about taxes, or the till, being the way to generate the resources for that, and our appetite as a community to do that is the first part of the question. The second part of the question concerns not doing what needs to be done, whether we have adequate decision support tools to say to governments and communities that a failure to act will result in this range of costs and consequences which actually make doing something not only virtuous but a quite rational, sensible thing in the first place.

DR GRAHAM HARRIS: Let me answer your questions in reverse order. No, we do not have the right kind of tools at the scales that we need them. That is right at the cutting edge of science and sociology and economics at the moment. What we need are the sorts of planning tools that will allow us to take rational decisions in a landscape scale environment. We are quite good at paddock scales, but we are useless at the landscape scale. We are now actually quite good at global scales, but the ghastly bit it that part at large catchment scale that we have not yet put together. That is something that we are working on from a CSIRO perspective. I would really like to pay a tribute to the people who worked on the land and water resources audit. That was an enormous advance in bringing together the economics of the regional scale modelling and the landscape understanding, but we have got to go further down that track.

Then to answer your first question: I think if we had the tools and we could actually paint the scenarios, I think some of the other policy and public perception questions would actually then come out, because you could draw out what are the trade-offs, what are the kinds of decisions that you can take, what are the implications of going down this road or that road. I just do not think we have those tools at the moment at our disposal. It is a criticism that the science has always been too fragmented; you know, people always wanted to work on their little bit, it was easier that way. To get people to work together, to get institutions to work together to put together those integrated tools is really what we are trying to do through our flagship programs. It is going to be a major challenge.

HON. DIANA LAIDLAW (South Australia): Just a brief comment first about regional planning, and I talk as a former planning minister. I attended last week the Great Artesian Basin field day which was looking at open bores and open drains, and it was phenomenal to see the saving of some 90 per cent from bores when they were capped, and the

better use of pasture as a result. One of the things that was disturbing is the 15 000 kilometres of open drainage in Queensland and, notwithstanding generous government subsidies, there is no money because of drought for the pastoralists to put in their required sum to make the changes on the ground. So I agree with you in terms of the incentives, but it is quite hard sometimes to get the individual means, notwithstanding the will of the pastoralist to make change. But it was a fantastic example of seeing big change across state borders and territory borders. I think it is harder at the urban metropolitan level than it was in the Outback.

But the question I have is: because of the huge problem nationwide that you have identified, and the many layers of government that the gentleman from Western Australia has just talked about, what is the essential immediate issue? Is it demand or is it the supply? Should we be focusing on the urban areas and the demand and usage and conservation, or putting immediate effort into the supply of the water systems and the biodiversity? Should we be making greater gains in the short term in terms of demand, and, otherwise, will we find that we cannot come to grips with the issue?

DR GRAHAM HARRIS: I think what I am seeing is a rapid movement forward in, if you like, demand management, re-use and recycling. We have done a lot of reform in the water industry, particularly in the urban water industry much of which we have privatised around the country, but we need to push forward as quickly as we can on the demand management and re-use side. It is now happening here, there is a proposal in Brisbane, and there is now a major proposal in Melbourne for reuse. We are starting to see the development of dual and triple replicated reticulated subdivisions, particularly in Melbourne and in Sydney, and I think you have them here as well. So, that is all moving forward.

One of my concerns is the issue of urban water security, storage and supply and alienation from rural use. As cities grow and as we start to alienate more and more water supplies in Perth, Melbourne and Sydney—and perhaps here—we are starting to see a trade-off between the uses of water, whether they be urban, secure storage or rural irrigation supplies. It is a particular issue around Brisbane, for example, with the really rapid growth in that area. My gut feeling is that we have actually got to think about both. We have to go back to the regional solutions.

In Brisbane they are talking about taking the sewage, as it goes out at Luggage Point and creates real problems in Moreton Bay, and piping it back up to Toowoomba (up 1 000 feet) to use for irrigated cotton and so on on the Downs. That will give us more problems because people say, 'We will have to dam the Clarence'. That is like waving a red rag to a bunch of environmental bulls. So, it is really both ends: it is watching what we do to catchments (preservation and storage) and it is looking at reuse and recycling. There are some quite massive schemes. The Virginia pipeline scheme here is one of the most forward-looking schemes in the country.

MS VINI CICCARELLO (South Australia): On behalf of everyone present, I would like to thank Dr Harris for his inspiring talk in which he highlights the challenges but gives us hope that there is a lot that we can do. Thank you, Dr Harris.

[Plenary session adjourned at 9.55 a.m.]

[Upon resumption at 11 a.m.]

WATER AS A FINITE RESOURCE—PRICE, INFRASTRUCTURE AND WHO PAYS FOR IT?

MS VINI CICCARELLO (South Australia): It is now my great pleasure to introduce Mr Graham Dooley, who holds a Bachelor of Science degree and Bachelor of Engineering from the University of Sydney, and who is also Master of Public Administration at American University, Washington DC. Mr Dooley joined North West Water Australia, now United Utilities Australia, in 1991 as Managing Director. He is responsible for managing the interests of United Utilities in Australia and New Zealand as well as supporting UU projects in Asia. United Utilities Australia has been successful in winning water industry build/own/operate contracts in New South Wales (the Macarthur Water Treatment Plant), in Victoria (the Yan Yean Water Treatment Plant) and in South Australia (10 water filtration plants along the Murray River).

In each of these projects UUA is a 50 per cent owner of the plant. UUA is also the operator of these plants. Prior to this, Mr Dooley worked for the Sydney Water Board and for two other large Australian organisations. At the Sydney Water Board Mr Dooley had several senior management roles, including Operations Manager for Sewage Treatment. In this role he was responsible for managing all aspects of the board's 31 metropolitan and Blue Mountains sewage treatment plants.

MR GRAHAM DOOLEY: Thank you very much, and what a great honour it is for me personally to address you this morning. The topic of interest is water infrastructure, but it seems to me that it is a pity it is not sewage. As the manager of Sydney's sewage treatment plants for a number of years, I had the great honour of dealing with nine unions that were all demarked between themselves and all united in their hostility to me as the manager, and I also had to report to the minister of the day, Janice Crosio, at 8.30 every morning on the operating status for the previous 24 hours of all sewage treatment plants.

Those like Peter Collins here will recall that in the 1980s sewage was all about how much went on the beach last night, as opposed to anything else. It was during my time there that Janice Crosio took her much reported swim at Bondi Beach to demonstrate her government's confidence in the activities of the Sydney Water Board. Janice was a very courageous minister, because the day selected was a particularly cold day, notwithstanding that it was the beginning of December. She stripped off on the freezing cold, windy Bondi Beach, plunged into the water, and was photographed for the evening news by three of the four networks, with some very uncomplimentary photographs of her. She subsequently lost a lot of weight as a result of that.

But with the ministerial courage that only you people know of, Channel 7 having turned up 20 minutes late, as a minister committed to her cause she did the whole thing again. It was just an amazing display of ministerial commitment. But I am not going to talk about that or about all the other war stories of sewage, which are legend. Better over dinner, I think, although I suspect that that would not be good for your stomachs. What the committee has asked me to speak to you about today is some of the infrastructure issues and pricing issues associated with water resources and water management in Australia today.

I suspect that your combined jurisdiction has probably the biggest and most valuable (in dollar terms) set of infrastructure in the nation. When one builds a city the most expensive infrastructure is the sewerage system; the second most expensive infrastructure is the water system; the third most expensive is the roads system and the fourth most expensive is the public health system. Gas, electricity and telecoms are way down the list, as are buses and some of the other infrastructures. So, when one talks about investment in Australia's water and waste water infrastructure, as a set it is the highest dollar value infrastructure in the nation. The question that has been confronting the ministers for water infrastructure, the parliamentary committees for water infrastructure and the agencies that planning water infrastructure is: how much should we invest in this infrastructure and who should pay for it?

The answer to that in 1924 when the legislation was first laid down in most of the then metropolitan cities of Australia is different from the answer that was arrived at in the 1980s when that legislation was substantially changed, and it is, I submit, different from what the answer is now. Let us canvass a picture of our nation's water infrastructure. There are three overwhelming uses of water. In the agricultural cycle about 80 per cent of the fresh water consumed in Australia is consumed in agriculture in one form or another; the other 20 per cent goes into industry and human activity. There is, of course, this emerging trend for an environmental use of our water resources. In other words, let water stay in a river system so that it sustains the ecology of that river system and sustains its environmental health.

We have seen the Snowy River debate about returning water to the Snowy River. Mark Brindal, in his capacity as Minister for Water Resources in this state, was one of the champions of increasing the amount of water in the Darling and Murray systems to keep the Murray alive and well. We have the sad situation in South Australia now that the Murray mouth is essentially closed and only engineering works will keep it open. The available potable water (that is, water that is fit to drink) comes only from these sources shown on the slide, and the ones that we have harvested most in Australia are the rivers and lakes. we build a dam—which is almost improbable with the planning processes now—and pump it to wherever it needs to go. Ground water is extracted by various bore hole techniques. Reclamation of water, that is, taking dirty or used water and reclaiming it for something else, is now creeping its way up the national agenda.

If you live in the Rhine river valley in Europe or any of the other great rivers of Europe or North America, by the time you in a city down near the mouth drink a glass of water, that glass of water has already gone through about six or seven human kidneys. It has already been drunk six or seven times by the time it gets to you if you are near the mouth of the river. In Australia we do not do that. We drink a glass of water and we throw it away, and it goes into the ocean. We do not reclaim any water for potable purposes in Australia, but I think that will change. That is one of the great challenges, and I will come to that in a minute, because it seems to me to be wasteful, and it is also part of the growth of our nation that we need to better manage our water resources.

Ocean and saline sources still present an opportunity, and in remote areas of Australia and parts of New Zealand some desalination techniques are used to convert that into fresh water. The cost of that is going down but by no means down far enough. The traditional role of governments in the water cycle has been the allocation of water between competing needs and, in the history of our great river systems, the east coast of Australia, the Murray Darling system and so on, there has not been much of a need for governments to do much allocation, because there has been more water available than the demand for it.

That has now dramatically changed. The environmental consequences have always been a topic of intense government activity through the rise and strengthening of the powers of the various EPAs and environmental regulators.

State governments in this nation have provided infrastructure. That is not always true in other parts of the western world, or indeed even the non-western world. Price has always been a sensitive thing in water. The price of water is probably more sensitive than the price of milk, bread, eggs, petrol and cigarettes that governments from time to time have regulated. Regulation as to appropriateness to health and all the other myriad of activities of corporate governance has been the province of government.

If we looked around Australia and New Zealand, except for Tasmania as a state and most of New Zealand, virtually everywhere else we have reached the sustainable capacity of our water resources that are immediately to hand. All the Australian metropolitan regions, and possibly Hobart, have reached the sustainable limit of their water resources, that is, use it once and throw it away. On the use it once and throw it away basis, we have reached the sustainable limit.

In Sydney, all the water in the Nepean, Shoalhaven and Hawkesbury systems is fully harvested. In relation to the Murray-Darling system flowing into South Australia, the limit has been reached for the purposes of Adelaide's water supply and there are some fairly severe forecasts that things will get significantly worse in Adelaide. Both Melbourne and Brisbane have harvested virtually all the watershed capacity that is around.

The water utilities, the water regulators—the departments and agencies of water resource management—are starting to look at this matter because they will need to supply more water or cut down demand for water if there is to be some balance. Water is marvellous stuff. You can over tax a water resource and if it rains it might catch up. That is what happened recently in Perth. The amount of water that is impounded in the storages in the Perth system have got down to low levels but, fortunately, as a result of another new dam and a bit of rain, it has gone back up.

I would not like to tax a water resource by allowing the total amount of impounded water to get below 20 per cent, but it got down to 17 per cent of the total capacity available in Western Australia. That is more than a year's supply and, if it had not rained for another year, Perth would have been in a very bad position. Most east coast rivers of Australia, that is, those which flow eastwards, except for the Clarence and some of those in Far North Queensland, have reached their sustainable limit. Most south coast rivers, not that there are many in South Australia and Western Australia, but those that flow southwards in Victoria and in the south-west of Western Australia have reached their sustainable limit. Most south-western rivers of Western Australia, those that flow westwards through the south-western region, have reached their sustainable limit.

The only places where we have not reached the sustainable limit are Far North Australia, that is, the Gulf Country, Arnhem Land and Cape Yorke; the Far North West, the Kimberley and Pilbara regions; Tasmania; and most areas of New Zealand. Simple physics, for those who did physics at school, water is heavy compared with gas. When you build a gas pipeline you can blow it in one end and it comes out the other. It tends to go up hill and down dale by itself. Regrettably, water is heavy and takes a lot of energy to move.

The idea of building vast dams in the North West of Western Australia, building a long pipe aiming at Melbourne and dispensing water along the way is not feasible under current cost structures. I think Richard Pratt, the Australian businessman, has a view that he would like to promote the harvesting of water in the Gulf Country at the top of the Northern Territory and north-western Queensland. I think that is viable. In my lifetime, we will see that harvested, I believe, in the next great Snowy scheme, but a few things have to happen.

What is the current price of water? That is a difficult question to answer. I have had a bit of stab at it. Some may howl me down. The bulk price is not the retail price. It is not the price that farmers (who come out of a reticulated system) or householders in metropolitan or urban Australia or industry pay. If one were to separate bulk from retail, as is done in the electricity system, out of the rivers the price is about 3¢ to 10¢ a kilolitre.

I had lunch on Wednesday with the Minister for Agriculture in Western Australia and he told me that in his area some farmers pay 0.03¢ per kilolitre. It is basically a 'give away'

price straight out of the rivers. That is the bulk of the use that is made of water straight out of rivers in the irrigation sector of Australia.

If we build a dam and connect it by pipe to a city it is generally somewhere about 7¢ to 40¢, depending on the length of pipe, the cost of the dam, the accounting techniques, the history of the pipe, the politics of the day and all those sorts of things.

Conventional water treatment where we take dirty water out of a river, treat it to drinkable standard and put it in a pipe system is somewhere about 10¢ to 20¢. Reclaimed water is about 20¢ to 60¢ because we must take out the bugs. If we are drinking sewage, we must take out the bugs to make healthy. I was speaking to Peter Collins about cryptosporidium and giardia; we do not want any of that going around from sewage to water to sewage again. A few issues in relation to that would be high on the public agenda. Desalination of brackish water, that is, ground water that is brackish, is about 80¢ a kilolitre; and seawater is about 180¢ a kilolitre.

On that scale, which would you do first? Obviously, you would put a dam on a river because it is the cheapest way of getting water. Our forebears in this nation dammed the Hawkesbury-Nepean system, the upper Yarra system and the headwaters of the Brisbane River system. Around Australia they did the cheapest thing first—which is the logical thing. Unfortunately, we have run out of rivers and dams. We have applied conventional treatment to about every drop of water we can harvest somewhere else, and we are now down into the reclaimed water section.

How good is our national infrastructure? Once we get it out of a river and put it in pipes, how good is it? The Institution of Engineers and about 20 other organisations, including a number of both federal and state government departments interested in this issue, have taken a snapshot of Australia's infrastructure. This is a fairly important snapshot that challenges the Public Works Committees of Australia.

The potable water is assessed to be about a 'C', in other words, adequate. That would be my sense of it. Most of the dams and most of the treatment plants are adequate, although there is a challenge, following the cryptosporidium outbreak in Sydney a couple of years ago, to ensure sure our treatment is up to scratch. Once we get water into the pipes, the great pipe systems that travel from the dams to the cities and the smaller pipe systems which travel up and down every street, things are not so good.

Although it is not news worthy and it does not attract much political comment, most of these systems leak like a sieve. If we are doing well, 15 per cent of the water leaks out and is lost to the system. In poorer cities it is about 25 per cent. So 25 per cent of the total water we

put through a treatment plant leaks out before it gets anywhere. That is a measure of the quality of the infrastructure.

The reason we do not read about this every day is because all the infrastructure is underground; the water soaks into the soil. Those of you who grew up in the country, as I did, will remember that the front yard had a big green circular patch or long green strip, which is where the sewage from the septic tank went. That is one of the techniques for finding lost water in water systems, namely, you look where the grass grows. There are other simple listening devices, like big stethoscopes, where you can hear the water running from the pipe.

The big water utilities of Europe, faced with pressing water resource shortages, have mounted enormous campaigns to find where the water leaks and to stop the leaks. While the utilities of Australia have done a good job, it is one of the figures they do not like to publish. You cannot get a lot of data about this because they do not like to publish this information because it is a commentary on how good the infrastructure is. It is certainly worth exploring. Plugging up a leak is a lot cheaper than building a new dam. On the scale of things, what would you do next? You would plug up the leaks.

In relation to the waste water system, we are not looking so good. The waste water systems of Australia leak like a sieve in and out.

A lot of rain ends up in the sewerage system, which is not designed to handle rain: it is designed to handle sewerage. About 90 percent of the rainwater that enters the sewerage system then flows out of the sewerage system before it reaches a treatment plant. It flows into the stormwater systems that are typically operated by councils. There is a lot of sewage in all of those overflowing creeks, manholes and all those sorts of things in a rainstorm in Sydney or as a result of persistent rain in Melbourne. These systems are expensive to maintain and they need to be fixed. Stormwater and flood control is absolutely abysmal Australia-wide.

Constitutional responsibility for stormwater and flood control is typically held at local government level, which is the agency of government that has the least amount of real access to capital to fix this sort of problem. It seems to me that there is a 10-year agenda for your committees in pursuing what is a sensible capital re-investment and rectification strategy, because we cannot build any more dams in these major cities. We must start looking at some of this other stuff. Regrettably, politics has got in the way of this recently because all state governments—under which these portfolios reside under our constitution—now have health, education and law and order at the top of the tree.

That does not mean to say that environment, water, transport, ageing and other things do not get a cut of the capital cake and do not get a cut of the recurrent budget. They certainly do. However, in terms of the very large amounts of capital that is demanded by the

water and sewerage system that seems to have been overtaken by these other more pressing needs of government. I would have to say that, having been recently a regular visitor to the public hospital system, certainly, as a simple observer of the system, there is a level of stress, as has been reported. The quality of care is magic. Everyone who has been to a public hospital in Australia will tell you that the quality of care from the doctors, the nurses and from other individuals is truly magic.

However, when one sees the signs of management stress one knows that accidents will happen, mistakes will be made and that the issues that are regularly reported in the 6.30 p.m. television news commentary will keep occurring, and that surely demands our nation's attention. Unfortunately, from the time that the major statutory authority legislation was enacted in the 1920s until now there has been a different carving up of the water revenue cake. In the 1920s when Sydney Water (or its predecessor) and the Melbourne Board of Works were created they were given the opportunity to raise revenue.

All of that revenue (100 per cent of it) from that time until the 1980s was applied to the water and sewerage system. From the 1980s onwards an amount of that revenue ended up in state Treasury. If one casts the net around Australia now (and I know that this is a little harder on Queensland and Tasmania where water falls to a local government level) where major state agencies are responsible for water, such as Sydney, Melbourne, Adelaide and Perth, about 20 to 40 per cent of the total water revenue raised by those agencies goes straight to Treasury in one form or another—tax equivalent regimes, dividend regimes, call it what you want.

It might be nice for me, as a water industry person, to say, 'Well, combined Treasurers of Australia stop this nonsense and we will put all that money back into the pipes and the water and sewerage plants.' That is unrealistic and we all know that, because, without that revenue, public health, law and order and education systems are under even more stress. So, it has become an absolute necessity of government that the cash surplus that these large trading entities generate will end up in state Treasury. Whether it is called a dividend or a tax equivalent regime does not much matter because the states' priorities demand a level of this magnitude.

For instance, in Perth recently the annual report of the Water Corporation of Western Australia was published. Working from memory, I think that its profit for the year was $296 million. Out of a total revenue just short of $1 billion, $296 million was a cash surplus, and some of it ended up back into capital works but the majority of it ended up in Treasury, and that will always be the case for the foreseeable future. About 20 to 40 per cent of a cash surplus, depending on which state we are in, ends up in the operation of maintenance and the overheads of the major water agencies, about 20 to 40 per cent ends up on debt service, that is,

paying for the debts raised to finance assets when they were originally created and, at the very most, 10 per cent is re-invested.

Now, 10 per cent is an optimistic amount. Sometimes some agencies spend virtually nothing on renewing their old infrastructure. Without constant re-investment this old infrastructure decays, it starts leaking, and it does not work so well. If this is the case, if there is a need and if we need to involve our ourselves in reclamation and desalination (which will be more expensive than building new dams) who will pay for it? The 1920s answer was that the population would pay for it through self-funded utilities, such as those created in Sydney and Melbourne at the time. The federal government might be convinced to pay for some of this stuff, and I would not rule that out.

In South Australia we have seen, in cooperation with our friends to the north in the Northern Territory, a very ambitious transport project, the Alice Springs to Darwin railway. That was a mixture of some very large amounts of state cash and a very large amount of commonwealth cash, plus some private cash. You put all of that together and it seems a useful model. One instrument that was used to fund infrastructure in the 1990s was these things called Develop Australia bonds or infrastructure bonds. These tax effective or tax exempt bonds (which enjoy considerable success in the United States, although it is in a slightly different form in the United States) were used to fund infrastructure.

In Australia they were seen as giving the superannuation funds of Australia the opportunity to invest in infrastructure. These bonds were used to supply the cash but they had an undesirable consequence in that federal Treasury ended up losing a fair amount of tax revenue from high-income individuals. The guys with the fancy braces who inhabit the major investment banking streets of Australia worked out how to flick these things out the back door and make a retail product out of it for people who had high taxable incomes, in which case the federal government gave these high-income individuals a huge tax deduction for no benefit. It was a secondary benefit not associated with the primary benefit.

As a company, we financed $100 million worth of infrastructure in South Australia when we built 10 water treatment plants up and down the Murray River. At those towns in South Australia, from Renmark (just inside the border of New South Wales and Victoria) right down to Tailem Bend (which is the last town of significance at the bottom of the Murray River) we have built water treatment plants. They cost $115 million to build, all as a result of private finance. We used infrastructure bonds to do that. The infrastructure bonds basically lowered the cost of the water that we produced by about 9 per cent. That meant, basically, that the federal government, through the tax system, contributed that 9 per cent. That is the way the infrastructure bonds worked.

We got a tax break through the infrastructure bonds and we passed that tax break to the government agency (in this case SA Water) through a lower price for water, and that was a great benefit. Unfortunately, the guys with the fancy braces flicked it out the back door and a whole lot of wealthy individuals are now getting huge tax deductions on the back of our bonds. That is undesirable. Federal government closed down Develop Australia bonds or infrastructure bonds for that reason, but it seems to me that an instrument that has the positive first effect—without having the undesirable second effect—is worth having in a financial armoury to finance these sort of infrastructures.

Will the state governments contribute large amounts of cash to infrastructure? I think not, given the delicate nature of the states' budgets. What we will probably see is much greater use of these public private partnerships, and our contracts with three state governments in Australia is, in fact, a PPP business.

What would it take to solve all of these infrastructure issues? I speak a fair amount around Australia, because I am one of the few businessmen in the water industry who actually has a multi state exposure. We operate in the five states and water is always reasonably high up the political agenda and reasonably low down the budget agenda—just a fact of life. We are one of the companies—there are three significant companies in Australia, us and two French companies—that are in the big scale PPP business.

My assessment is that the unit price of water needs to increase, to change human behaviour not to raise more revenue. I am not interested much in more revenue for the state water utilities, because ministers of water and treasurers can now set the revenue at whatever they like, to raise whatever revenue they like and contribute whatever sums they like to state Treasury. That power is there now.

One of the things in my career, which is now 30 years in water, has taught me is that when you change the price of something and you publicise that well you actually change human behaviour. You do not often sell more of it or less of it, but you change human behaviour in a very desirable way. Let me give you two examples. There are two case studies—two and half case studies, two in New South Wales and a small one in Western Australia that are relevant here. In Newcastle, north of Sydney, they ran out of water. There were no more dams to be harvested and the next water resource was a long away way and going to be difficult and expensive. So in the early 1980s, under the then leadership of Dr John Patterson, who later went to the Victorian Public Service, they raised the price of water about 70 per cent. Now, 70 per cent is a big rise for the price of water. It went from something like 30¢ to 50¢ or 55¢ per kilolitre in the '80s.

That was in conjunction with a very substantial publicity and community consultation campaign. What happened? Basically the consumption of Newcastle dropped

30 per cent overnight. No-one actually paid more in water rates because people moderated their consumption. For those who had the lawn tennis courts and the exotic gardens who couldn't care less, yes, sure, they paid a lot more; but they couldn't care, and that is just a tax on people who couldn't care. But for those who were conscious of their domestic budget and those who wanted to do the right thing there was an opportunity there not only to keep their water bill the same but actually to reduce it.

The same thing occurred in Sydney in the early '90s, faced with a drought. Sydney Water, in concert with the government of the day, of which I think Peter Collins was a member in those early days, did three things together. The price of water increased by about 50 per cent; restrictions were introduced because of the drought, so restrictions on using water hoses and all the other things that you normally apply; and the third thing was there were some spectacular prosecutions and a massive publicity campaign about it all.

The spectacular prosecutions of people who were wasting water or breaching the restrictions had an amazing impact. You only needed to get a few people with the TV cameras in their faces as they were going in or out of the court on the 6.30 tele-journalism report on all of the channels, and you get a few of those spectacular ones. It does not matter that they were fined $1 000 or $500. That is inconsequential. Just the spectacular publicity of people getting prosecuted for being wasteful with water changed the behaviour of 3 million people in Sydney. And also there was a sticker on the side of every bus about saving water. Peter Collins will remember that. You know, those great big stickers about saving water, and shower with a friend, and all of that other good stuff that goes with those campaigns.

But Sydney's water consumption dropped 30 per cent. No-one actually paid much more in water bills. The number of people who paid more was the wasteful few. Most people paid about the same, and there was plenty of helpful guidance about how to do that. Sydney Water's revenue stayed about the same. Their contribution to treasury stayed about the same, but the unit price of water had gone up, and that caused people to start making that decision.

The unit price of water in Sydney has remained about the same in real terms; it has gone up with inflation. Have a guess what people are doing? They are back to the old, wasteful habits. Water demand is starting to rise. Time for another sticker on the side of the buses and perhaps time to do something else. But in those cases where human behaviour changes beneficial results are achieved.

As far as what $1.50 does, however—let us image here in Adelaide the price was $1.50, it brings desalinisation into view, because at that sort of money companies like mine will desalinate large amounts of not necessarily the ocean, but certainly with Lake Alexandrina, which is a bit brackish, we will desalinate that for less than $1.50. So suddenly, not only does it change human behaviour on the demand side it changes corporate initiative on the supply side.

What about rural? My view, for similar reasons, is that the price for rural water ought to be about 15¢. The reason I say 15¢ is that there is a little bit of history that when the water gets up to about 15¢ the growers of Australia start using some fairly innovative agricultural techniques. However, to do that overnight—as you would do in metropolitan Australia—in rural Australia is absolutely not on. You cannot do that. There is a mixture of both major parties here at this conference, and everyone will recognise that by increasing the price of water in rural Australia from 3¢ or 2¢, or whatever it is now, to 15¢ is the kiss of death for most towns and most rural industries.What there needs to be is a certainty in a price increase into the future but also a subsidy through some means—maybe that revenue is turned around—to encourage growers to invest in better water infrastructure such as drip irrigation, rather than sprays and so on.

Flood irrigation is an environmental disaster. We all know that. Spray irrigation is also just very wasteful. When you have these big broadcast sprayers, and John Dawkins, who is here, and I know that with these huge sprayers, that broadcast a stream of water that goes out 50 metres, about 10 per cent of it ends up in the roots of the plants and 90 per cent of it ends up in the atmosphere somewhere because it all evaporates. A grower like that, subsidised for his infrastructure, could tolerate a 10-fold increase in water price with no effect—a 10-fold increase in water price with no effect, if you were able to apply the water directly to the roots, as the grape growers in the Barossa do through their drip irrigation.

MR VENNING (South Australia): Hear, hear!

MR GRAHAM DOOLEY: Yes, the member for the Barossa, Ivan; we supply his drinking supply. But you could have a 10-fold increase in the price of water and everyone would be ambivalent about it. These are the sorts of programs. I am not talking about a one electoral cycle program, where you are looking forward three or four years. You have to look forward a decade. Water resource planning is decades long. When Mark Brindal was minister for water resources in South Australia he and I had a number of discussions about how far you need to look ahead for the Murray River, and it is probably two decades. You cannot do anything in a whole river system in under two decades. That is many electoral cycles, and the politics of Australia in a number of states is very evenly balanced. So the rural electorates are going to cause governments to rise or fall. This needs to be handled extraordinary carefully, but in the nation's interests I think it needs to be handled.

My answer to this in terms of who should pay is something along the following lines, and I do not know whether there is a single right answer or a single good answer, but I think there are some answers emerging. We know the ratepayers of Australia will continue to pay rates and charges for water, and I am promoting a higher unit rate, without anyone necessarily paying more. We know the government water utilities are going to remain in

government. Is any government representative in this room truly going to sell a water utility, à la Victoria's electricity privatisation? I think not. Are they going to lease out a utility à la South Australia's ETSA privatisation? I think not.

I think government water utilities are going to remain as agencies of government and they are going to produce a large cash inflow to Treasury year by year—fact of life—at least in the next five or 10 electoral cycles I think. However, where are the large amounts of cash? If you look around Australia, who has all the big lumps of cash that we can convert into infrastructure? The capital markets have an enormous amount of cash because of the compulsory superannuation provisions. There is a very large amount of cash sloshing around there. The federal government has got the only really discretionary bunch of cash, big lumps of cash. I notice in the *Financial Review* this morning this debate about whether the federal government should retire all its debt has come up again, and there are some articles there about the commonwealth bond market and all those. I would think that, rather than retire all government debt, which may be a good fiscal move, taking some of that cash surplus and investing into the infrastructure of Australia may not be a bad thing.

Maybe we need some more Alice to Darwin railways in the water sector. Maybe we need to harvest water in the Gulf of Carpentaria and move it south into the headquarters of the Darling River system, or something like that. There needs to be a bit of vision here about where we apply large amounts of cash that have been generated by governments (principally federally but also state) over recent years.

It seems to me that, if we look at the partnerships with Victoria and New South Wales and the recently issued South Australian PPP guidelines, there is useful harvesting of cash available in the capital markets, the cash that is available from the federal government through tax subsidies—existing tax subsidies; I am not talking about the Develop Australia bonds, although that would be another little spin—which can be put into PPP type programs. PPPs have some elements of a good track record and some bad. I am happy to offer some advice.

Obviously, as a company involved in PPPs we see that they do a good thing. I think that Ivan Venning, the member for the Barossa, would say that without a PPP in South Australia his constituents probably would not have got filtered water for another 10 years. It brought some of the infrastructure forward 10 years ahead of where it would otherwise have been. I think Sydney Water (under the government of which Peter Collins was a part) went down the path of having PPPs in the water sector and they got nearly $1 billion worth of water infrastructure—notwithstanding this cryptogiardia business a couple of years ago, which was a bit of a furphy. Basically, high quality water infrastructure was provided to Sydney in one fell swoop in very short order. I think government water utilities will always have some in-house

capability and some outsourcing capability, but basically the big lumps of cash will need to be focused through some more effective delivery mechanism than what we are currently doing.

What are the next challenges? I have spent 30 years learning about this industry; it is about time that I contributed something to it, so I am looking at some of the big challenges. In my capacity as the National Policy Director for the Australian Water Association I am often asked for comment by governments of Australia. I have appeared before a number of parliamentary committees (both federal and state). I am also doing a reasonable number of interviews on this subject. It seems to me that the best bang for the buck, first up, is stopping water that leaks out of channels. In northern Victoria and southern New South Wales, water is leaking into the landscape—the south-west of Western Australia is not exempt from this either—and mobilising the natural salinity of the Australian geology.

Australian geology is full of salt; the last thing you want to do is wet it, because when you wet salt it dissolves and moves, and then the water stops flowing, it crystallises again, and you get the salt in a different spot. If it gets into a river, you cannot get rid of it easily. Go to the Dead Sea in Israel and see the amount of salt that builds up there are over aeons. It seems to me that refurbishing the ageing urban infrastructure is right on your agenda. At some stage, you will have to deal with a big pipe (a water pipe or a sewer pipe) collapsing and someone, a bus or a house falling into it. These big pipes collapse with old age. If you look into the engineering fora that are convened periodically around Australia, you will find some horror stories about old infrastructure and things that are inside pipes and the fact that the reinforcement in the concrete is all hanging loose like so many streamers hanging out of the roof of these things.

There is all that sort of stuff around. That will require a lot of cash. Do you know how much revenue you are able to generate from the customers of Australia for that? Not one cent, because the customers of Australia expect you to have had the cash reinvested in this infrastructure over the years. So there is a big political issue about raising more revenue for renewal.

I think Richard Pratt's vision has legs, and we as a company are working on it. To move very large amounts of water from northern Australia to southern Australia seems to have merit. Three things are needed for this vision to be achieved. The first thing is technology. To put it in a pipe and pump it will be impossibly expensive. So we need to invent some other ways of moving water. The Romans invented those: they are called canals. We have to get some decent canals and the means of propelling the water along them using solar power or something like that, because we do not have any power stations out there.

The second thing that is needed is that the price of water has to increase. If the price of water paid by irrigators in western New South Wales, northern Victoria and South Australia

was increased to about 15¢ this would become affordable under a sort of Alice to Darwin PPP type of structure. The third thing is that the regulators of Australia who sit in the parliaments have to get their act together to make it happen from a regulatory point of view, because when we have projects in Queensland trying to deliver water into New South Wales and Victoria, there is a regulatory mess at each border. A commonality needs to emerge on the regulation side.

The next thing is what I call the whole-of-city water balance. Adelaide leads the way in this, I am proud to say as a recent South Australian resident. You look at the whole of the water cycle of a city (the freshwater and wastewater cycles) to see whether you can go around in a circle rather than use it once and throw it away. This is challenging because the health regulators, your colleagues who sit in the health fora of Australia as the health regulators of the state parliament, basically will not let it happen. You cannot drink sewage in Australia. The health regulators say you can't. You can in Europe, Britain and North America where they say that you can, but in Australia we are prudently conservative about that. I suspect that the health regulators of Australia will be convinced to allow that to happen with some care and prudence in relation to the transmission of disease.

The last requirement is innovation. If you look at what has happened in the water industry in the last 20 years, it used to be all about pipes, pumps and dams. At the moment, it is not; it is about scientific instruments, electronics, sophisticated control, a whole lot of water chemistry and biology, some really innovative wastewater treatment processes, membranes, desalinisation and all of those technologies suddenly merging in the next 20 years. And do you know what? They are all affordable. For the first time ever we can afford to convert any type of water to any other type of water. You can convert sewage into drinking water, sewage into irrigation water, saline groundwater into drinking water. All of these conversions are all possible and all within some sort of reach.

It seems to me that, at this point, having closed out the millennium and entered a new one, we have a lot of things going for us. We have the technology to do whatever we want, we have a price which people are prepared to pay for water which will probably make it all do-able, and we have a will environmentally and from our regulators to make it happen—and I think that is tremendous.

Will the water in the northern rivers be tapped? I think so. I think there is probably an argument for also using the Cooper and Diamantina River systems. I suspect that my thoughts on that would be best developed on another day in another place, but it is a great challenge. Thank you.

MS VINI CICCARELLO (South Australia): Thank you, Mr Dooley.

MR KEN SHIRLEY (New Zealand): Thank you very much for your presentation. On behalf of the New Zealand delegation I thank you all for the very warm welcome you gave me. My name is Ken Shirley and my colleague is David Cunliffe. We have taken the hint about a future meeting in New Zealand. I am sure that our colleagues back home would be very receptive to that proposal, so we can talk about that further.

Graham, the theme of your address was price infrastructure and who pays. You touched on the ownership but you were very dismissive of it. To me it seems that the deferred maintenance problem is a function of ownership. Because it is in public ownership, the pipes are in the ground, out of sight and out of mind, and it is intergenerational theft. The politics is that you keep pushing off that deferred maintenance factor. You put forward the PPP model. I say, why not go the whole hog and privatise? People say that water is essential, but so is food. We do not say that the government should run supermarkets or farms, so why should the government run the ownership of water? Could you expand on that please?

MR GRAHAM DOOLEY: My view is that it is just too hard politically to push a water utility into the private sector. It was hard enough to push the electricity utilities of Victoria into the private sector. New South Wales, even with the conservative parties and the Premier and Treasurer of the Labor Party in favour, could not do it. The obvious answer is what you say. If you strip aside all the rhetoric of the British privatisation of water utilities and get back to the fundamentals, the infrastructure of Britain had truly had it. Who was going to find the £50 billion pounds (that is $A150 billion) to make the infrastructure good? It certainly was not going to be the public budget, and that was the major motivator of privatisation in Britain.

I think that the same fundamental principles apply here. It is the private capital markets that have the large amounts of capital, but you need good regulation. You need the social safety net to stop all those monopolistic practices of companies, you need to cap revenue, and all those other good things. I think that the British model, stripped of all the politics, actually works, although I do not think it is going to happen in Australia and New Zealand. However, the PPP model can be adapted to deal not only with greenfield sites, where you create a new water treatment plant or new pipeline and all the through-life maintenance for decades is part and parcel of the deal, but you can also look at brown field sites.

At the moment, the government of Victoria is considering a $200 million upgrade of one of the two major sewage plants in Melbourne. That will take over all the 30-year-old infrastructure, which sorely needs a bit of work, and involve that in the project. So, I think it is doable. It is not as clean as a wholesale privatisation but I think it is doable.

MR MATTHEW BROWN (New South Wales): We have been looking at PPPs for quite some time, and most of our new water treatment plants are indeed a PPP and there is

nothing new for government working in with the private sector. Despite going down the privatisation line, how would a PPP actually work and where is the money going to come from? A number of examples were looked at in Britain, where they had private companies build schools, but that just seems to form a recurrent debt for future generations of politicians. All the baby boomers on the Treasury benches now have been able to cut these ribbons for these terrific projects and then younger politicians like me will just be managing a debt in future generations.

We are quite reluctant to see how some of these PPPs work in detail. What is different from the arrangements happening at the moment with companies like yours and Vivendi, which has a large market share of New South Wales?

MR GRAHAM DOOLEY: I would like to offer two thoughts. The first is that engagement of the private sector in design and construct contracts is nothing new, and I do not regard that as a PPP. To get a builder to build something, even if the builder has to do the design as well, is not a PPP. A PPP seems to me to be a delegation to a company like ours of those risks not only associated with building and operation but also associated with ownership. As you rightly stated, the through-life maintenance costs that fall to an owner rather than a tenant are historically the big costs in a project, so delegating the whole of the ownership risk for decades at a time, certainly, has some finance attracted to it, but companies like mine raise money.

We raise debt at about the same cost as state treasuries. Big corporations of the world borrow money at about the same price as state treasuries do. We are not AAA, and AAA does have a bit of an advantage. But backed by a guarantee in New South Wales it is tantamount to our borrowing at AAA. So, the debt is not much different whether it is raised in the public or the private sector, except for the balance sheet implications. The second issue is that the thing that is attractive about PPPs is the ownership and finance issue. We are the water utility in other parts of the world. We have all the corporate norms and behaviour that a water utility does and we are as good, competent and caring and as mindful of our corporate responsibilities as, say, Sydney Water or Melbourne Water.

I think there are some divides there that are shown by fact to be not figments of imagination. We and other companies like ours need good regulation. There is no doubt that companies need to be regulated. We do not want any Longford gas explosions in the water industry, or any of that sort of nonsense. They need to be properly regulated. But the amount of capital that is available to take those ownership risks away for government needs to be at demonstrably lower costs. In New South Wales and South Australia, where treasuries have studied whether a PPP should be used to create something, both studies have indicated an overall lifetime lower cost by doing it as a PPP rather than as a traditional design and construct.

MS VICKI DUNNE (ACT): Much of what you said about turning back the rivers, the Diamantina and the Cooper, is somewhat in contrast to what Graham Harris said this morning about the sustainability, the working with the environment and keeping pristine as much of what is pristine as possible. Without going too much into your one day seminar on the virtues of this, do you see a contribution by a new Snowy scheme, which many people say we could never politically do again, and does it run in contradiction to your proposals for increasing the cost of water as a means of encouraging people to be more thrifty with their water? Don't these things work against one another?

MR GRAHAM DOOLEY: Graham Harris and I are good friends and we do speak across a spectrum of issues. I think that the Snowy scheme is a spectacular success in the nation's interest, but one of its great failings is that water was free. At the end of it, water washed across the Murrumbidgee and the Lachlan river systems and was free, and people would do with it whatever they wanted. The governments of New South Wales and, to a lesser extent, Victoria, in the Murray system could just regulate the use of this water, and it was basically given away to anyone who wanted flood irrigation, or whatever. So, the whole of the landscape of southern New South Wales is now wet. That is environmentally unsustainable.

The view I have is that if Pratt's vision is ever to be implemented it needs to be implemented in an absolutely environmentally sustainable way. This idea of introducing vast amounts of flood waters into the northern reaches of the Darling is just not on. It needs to be very carefully managed and it needs to be very carefully selected into which particular river beds it flows, and the ecology of those river beds and the sustainability and salinity mobilisation that might or might not occur all needs to be done. But it seems to me that there is a technique for moving that water largely through existing watercourses. There will be some man-made canals, but it needs to be sustainable.

Graham Harris and I are absolutely on the same wave length in terms of sustainability. My view is that to have water flowing in a managed way through those watercourses is to be preferred, rather than leaving it arid. I think that the price of water will make sure that every drop truly is precious.

MR DAVID CUNLIFFE (New Zealand): Thank you for an excellent presentation. If good regulation is required in an environment where bigger is better and there are increasing returns to scale, it is perhaps unlikely to be found in the nature of general competition law, as most projects will probably have one company from dam to tap. That leads us to rate of return or price control regulation, which brings with it its own problems: feather bedding, gold plating, etc. Have you any comments on what good regulation means to you in a PPP environment?

MR GRAHAM DOOLEY: We are a company listed on the London Stock Exchange. Our returns to our shareholders are moderate. Our shareholders are basically superannuation funds that want a rate of return better than bank interest. So, our shareholders get a rate of return that is a bit like an inflation-proof bond, probably a couple of percentage points above the prevailing interest rate, but protected over the long term. The government regulators of the UK who have the principal impact on our pricing and so on, and the way in which we interact with governments in Australia, is always some sort of price capping. There is always price capping in ours. Bigger is not better in the water utilities.

You do not invest in a water utility company to get rich: you go into speculative uranium mining or something like that. You invest in a water company to preserve your capital and get a modest rate of return over a long period. That is the nature of it, although we sometimes get accused of all this rapacious price gouging, and so on. The reality is that it does not occur.

MS VINI CICCARELLO (South Australia): I'd like everyone to join with me in thanking Mr Dooley again for his very interesting presentation.

[Plenary session adjourned at 12 noon]

[Upon resumption at 4.10 p.m.]

WATER RIGHTS: A NEW DEFINITION

MS VINI CICCARELLO (South Australia): We will get started for the last session this afternoon. I am sure Mike Young is well known to us all. Before I introduce Mike, I would like to say that he has a couple of special guests this afternoon—his parents Madge and Henry Young are here to listen. They have always wanted the opportunity to hear their son. Jim McColl, who assisted in writing the report, is also here.

Mike Young directs the CSIRO's Policy and Economic Research Unit and is an Adjunct Professor with the Centre for Ecological Economics and Water Policy Research at the University of New England. He was inaugural President of the Australian and New Zealand Society for Ecological Economics. He is also a Fellow of the Academy of Social Sciences.

Mike specialises in the development of policy principles and their application to resource management issues. He is best known for his contribution to the design of the tradeable property rights system; the development and implementation of Australia's national land and water resources audit; the debate on environmental flows for the Murray-Darling Basin Commission; understanding the adverse effects of support to agriculture on the environment by working with the OECD in Paris; and the development of incentives to improve biodiversity conservation measures in Australia. Working in close partnership with Carl Binning, Mike has pioneered much of the early work for the use of incentive instruments to conserve biodiversity in Australia.

PROFESSOR MIKE YOUNG: Today, I want to talk about something which is incredibly important. It is about how you build the foundations for something that might last. If you think of this building, you all expect it to be here in a few hundred years' time. The leather seats might change but, ultimately, you expect parliament to be here as an institution, still leading us into the future with pride and excitement.

To do that we need a similar framework for water resources. I want to talk about what that might look like. The systems we have in managing water resources were developed in an era when we had lots of water. We did not worry about how we were going to use it; it just came. We rolled out systems that were tailored to do little things to build big schemes without thinking about where we were going to end up.

More recently, we have introduced caps, trading arrangements, salinity management and pollution controls—all bolted on. We have bolted on and extended the house, and the house is starting to look very flimsy, shaky and flawed. Parliaments around Australia are

fighting, arguing and discussing about what to do with water resources and how to put on more props and bolts.

We could go on doing that or we could go back and think about what would be a fundamental solution, something which would make water allocation, water resources and water licensing boring. In the same way as you do not have debates in this house about the foundations of this building. Some issues were solved last century.

We are really talking about finding a robust way to define interests and obligations associated with water. I say 'interests' and 'obligations' very carefully. It does not help to talk about property rights because property rights are a vague concept with lots of different meanings. Lawyers, when they sit down, start talking about obligations and interests; about how to share; about how to allocate; about how to distribute; and about how to use. These are very important ideas, all within what clearly must be an efficient and fair trading framework. We cannot avoid that. It is here today.

Several years ago, COAG (Council of Australian Governments) noticed that we had a single title to land and water. In their wisdom they said, 'That's wrong,' and signed off at the highest level. They said that we should have land and water separated: defined and managed totally separately. That is where we have gone as a nation—managing land and water separately.

Some things happened in the process. Land remained as a new system title. When we separated water and land we moved management of water back to an old system titling. Governments around the world have spent a lot of time and effort moving their old land title systems through into a Torrens title land title system. COAG took water resource management back to the old system title framework.

The way in which they did it is interesting. They also said that we would have to have tradeable rights and we would have to do something about price. The communiqué today talked a lot about getting prices right. I will leave that to others. I will leave you to think about price at another time, at another forum, and talk about how you might set up tradeable rights; to think about what you might do if you wanted a really robust system; and to go back and look at the critical, fundamental concepts. What really matters if you cast the net wide and search for the clues?

Some really important things happened in a period of about seven years. In 1862 in England, a brand new act was introduced. It was a companies act with limited liability. Lord Sherlock, Robert Lowe and Lord Bramwell said that there must be a better way to do business around the world; that there must be a better way than what we are doing it at the moment.

They said that there must be a robust solution which can enable commerce of the world to go forward. They said that if we added "limited" to the end of each company name to create limited liability companies with shares and boards and dividends being paid, we would have a revolution. Within about 20 years, there were millions of companies all over the world. There has been no need to change the model.

These three gentlemen solved a very important problem which had challenged commerce for thousands of years. When the Greeks and Romans were trying to work out how to do things, no-one saw their way through. Suddenly, three men said, 'It's really easy, you just do it like this.'

Since then, the world has gone forward in leaps and bounds. It is very obvious in hindsight, but no-one saw it. Similarly, people sat down in this parliament, in 1857, guided by Robert Torrens (who became Sir Robert Torrens) introduced the Torrens title system. The brains to this system was actually Ulrich Hubbe, not Robert Torrens. Ulrich Hubbe, who was in the department working for Robert Torrens, said, 'If you want to solve land title registration do it the way we do it in Germany with ships, which has a totally different registration system. If you do that for land you will have no more problems.'

They brought it to parliament and, importantly, the act was an act to simplify the laws relating to the transfer and encumbrance of freehold interest and other interests in land. I stress that, by defining interests rather than property rights, they got to the hub of the problem and solved it.

Revolutionary, South Australia has made a fortune teaching the rest of the world how to set up land title systems. It happened six years before companies were invented. These are two very fundamental concepts.

Many of you are on environment committees, halfway between the development of these two concepts. Charles Darwin released *Origin of Species*. In six years of history, three of the most fundamental things in the world happened.

The Torrens Title Act looks like this and is signed by the Governor, who certified and brought it in. It is still bound and available. I challenge you to think about what something in water might look like, if you wanted to do the same thing for water, so people in future can say, 'They did it in Australia.'

The brilliance, in terms of critical concepts, is that the Torrens title system formally guarantees register of ownership and interests. It does it by saying, rather than having lots of piles of paper and lots of records, as all the water licensing systems do, you register it in a central book. It is written down. If there is an argument as to who owns it, you go to the book

and the law says that whatever name is there is the person who owns it. It is guaranteed 100 per cent. If there is an interest or mortgage on that book, if it is registered there, the government guarantees it—no questions or debate. The same thing could happen in water.

They have formal settlement procedures. Water trades in Australia are sometimes over $3 million a trade, yet we do not have licensed brokers or formal settlement procedures. There are some situations where trades have been done, the paperwork has been wrong and they have had to be undone. We do not realise we are now in serious business and serious financial arrangements and the deals are often more valuable than land trading. We have had not learned what we learned in this chamber well over 100 years ago.

We need systems that have low risk and minimal fraud. Low access cost to loans result from these systems. We have such low cost access to money and the guarantee because of the way in which the registration systems work. A mortgage, when it is registered, is guaranteed. It is not like going along to the bank with your car and saying, 'Well, there is some sort of security tied to it.' The interest rates, we all know, are higher for those, and they are higher for good reasons because we do not have a guaranteed registry. If you go to the other system you get investment security.

The banking system is another robust system. All of you have money in your pockets, or at least I expect most of you do. None of us has to worry about whether that system is going to go wrong. Money is a wonderful thing. You do not even have to write your name on it. It is managed totally differently to the way you manage share scripts and titles to land. We all know that you do not need to write your name on each coin or each note. Thousands of years ago we did; we no longer do that. We have cheques and very low-cost trading systems. Somewhere along the line some very bright people worked out that there was a need for double- entry bookkeeping. If you have one system from top to bottom that adds up to one, and every time you move something from one you must debit it and credit it.

It is very simple. The rule is that you are not allowed to credit without debiting. It was worked out centuries ago and it works to this day. Every time you look at your bank statement you assume that someone has done the debit so that you get the credit, or vice versa, and you would have fits if it were done differently. Again, it is simple, robust and sensible. The exchange rate protocols are very well worked out. You know who is taking the risk when you do an exchange, at what time you have done the exchange and when the risk is now yours and when it parts from being someone else's risk. It is well worked out and well understood.

We can look to other very important concepts. In economics, my profession, a very famous man, Tinbergen, the world's first Nobel laureate in economics said that if you want to have something that is dynamically stable and robust through time and have something that can adjust without having to change the fundamentals, to call in the bulldozer, knock it all down

and start again, you must use separate instruments for each policy objective. We have all forgotten it now, but back in the 1950s, when he was awarded the first Nobel prize, it was regarded as one of the most important concepts to bring into parliaments of the world.

It told you that if you want to manage things you must manage them with separate instruments. If you want to drive a car you must have a clutch, a brake, an accelerator, a steering wheel, switches for the lights, etc. You do not try to drive a car all with one switch—at least I hope you do not. If you try to think about it in terms of water (and I will come back and expand on this), my work with Jim McColl suggests that you need at least three fundamental components. The interest needs to be registered on something like a Torrens title system, with something like shares that are mortgageable.

It is a true contract with both parties obliged—not what we have at the moment, where you have an all-care licence system but no responsibility—and where risk is stated transparently. If you expect people to take risks you tell them of the risks. Tell them transparently if you are going to change the allocation in the future so that they expect it and it is communicated openly and honestly to them. When allocations are made the quantity of water that is available, the buckets you get this year, should be managed much like we manage money: you transfer it around in a very simple way. There is then the way you use the water, what happens and the third party obligations.

Again, use is a totally separate issue that must be managed separately and reviewed periodically. But if you reviewed that bit you should not have a system that opens up all the other bits you have already solved. If there was an allocation problem you solve the allocation problem. You do not have a system (which you have at the moment) where, if there is a flaw or something that needs to be changed, you must change the whole lot. Bits that are fixed, you leave fixed so that you can make progress. Nations that deal with a bit at a time, solve it, put it away and get on with the next agenda make progress. If we keep tearing up the whole thing and going back to square one we will not make progress.

Let me talk a little about the entitlement, the first bit, and what that may look like. If we look at the insights from law and from company law, in particular, how do you share something into the future, where you are trying to work out how much each person gets and the best way to do it? We worked it out in 1862. You have shares. If you wanted to give shares in a valley you would have a total number of shares in the valley, say, five million, and would you tell everyone what their share is. If necessary, you can have preferential shares and have more than one class, but you need to think why. If you want to have high and general security you have classes of shares, because you are still saying that the future might change, that we might have a dry period.

Droughts might come along. You might have a decade—as we have had a number of times since white settlement in Australia and records have been kept—when it has been 10

or 20 per cent drier for decades at a time. It is important to communicate that this happens to farmers and to other water users and not to tell them that we guarantee 100 per cent that it will keep raining, because as all parliaments know, they do not have the power to do that. We can set it up, if we want to, as a dual system, and even more, and I will go into the complexity about that in a minute. An important observation I want to make is that as you lower the cost of trading allocations you need fewer numbers of classes of shares.

If you have a shonky system where trading costs are very high and adjustment in the marketplace is very expensive you must have many classes of shares. If you could be as good as the banking sector and get down to being able to do a trade for $1 or $2, and even do it over the internet, you would need a much simpler system because you can leave the marketplace and commerce to do it. If you want to keep it as a government, keep the complicated system and keep the trading cost high. It is your choice. Importantly, we learn also that you must specify risks. Essentially, three types of risks are involved in water resource management, the focus of this conference. There are adaptive risks.

You know that there is going to be that variation. You know that, from time to time, scientists and people from the CSIRO, and where ever else, will come and say, 'We have been doing our sums, modelling and other things and we have realised that there is less or more water than was there previously.' If you say, 'Look, that is for you to manage', and it is transparent, there is no problem. There is also an issue with land-use change that I will come back to, but you must be honest about the consequences of land-use changes for irrigators, because land-use change changes the quantity of water that is available. There are different ways you can debate this, but it is important to decide and to be honest with water users about which way you are going.

Similarly, there are claims where you can make compensation, and by compensation I mean that you can take a claim to the courts and you can make a claim against the administrative agency because it made an error. The Torrens title system and its strength is that the government guarantees that if it makes an error it will fix it up and pay full compensation, plus payment for the damages associated and the inconvenience caused. The government runs a system where it guarantees it will not make a mistake. I think that all of you know that mistakes are incredibly rare, because the system is noted for doing that.

Similarly, I think that there is a strong case for over-allocation being compensated. If a government looks at the total amount of water that is available and goes on allocating once you have got to that—if ministers keep writing licences out, knowing that people have already hit the limit and hoping that all the people who have current licences do not ever use that water and then down the track in history they decide to use it (as is happening in a number of states in Australia and elsewhere in the world)—I think the people who assumed that their licence was a

valid one have a claim on the basis that all agencies have a duty of care to stick behind the documents that they write.

If you write a document that communicates one thing and you mean something else, arguably, there is a role and a need for compensation to be paid. Similarly, I think that there is an opportunity and an argument—and you might choose to debate this—about when there is a rapid, sudden or unexpected policy change of complete reversal to at least assist structural adjustment through that process. Finally, there is uncertainty, the things that we all hope will never happen.

They are very hard to specify, but certainly with the catastrophes when dams and things fail I would expect parliaments to act in the way they always have. That is a separate issue. But specification of risk in an open, honest, transparent way is critically important.

There is an argument that you could move land use change through into the compensation area, and I will develop that a little bit further in a minute. But let me first of all tell you about another very important issue. Both speakers this morning, and in the hypothetical, got very excited about improving water use efficiency. Let me tell you the scientific bad news, which is one of the most serious problems I think facing water use in Australia and critically important. Think of a little scenario as follows.

There are fifty farms all with a normal water allocation, about 2 000 megalitres. That means 100 000 megalitres of water is pumped. If it was measured to be 50 per cent water use efficiency, and that is the sort of efficiency that is achieved when you irrigate pasture for dairy, just for actually grazing animals, which most of the water in the River Murray is used for, that means that 50 000 megalitres is evapo-transpirated or carted out in the products, but that is the amount that is used. The other 50 000 goes back into the river, either via the groundwater or through drains. This is important. Half of the water goes back into the river and is used by somebody else. If you then trade that, as is happening, trading it from pasture through into viticulture, guess what happens? They go to state-of-the-art scientific technology with drip irrigation, and if you do that only 10 000 megalitres returns to the river and for others to use and for the environment to use.

That means that other irrigators and the environment lose 40 000 megalitres. Yes, there are some time delays, but ultimately every time somebody increases water use efficiency they either rob from Peter to pay Paul or they rob from the environment. But it is only raining once, I am sorry to inform you and there is only one lot of water flowing through the system. If you increase water use efficiency and you do not take the water from somebody else, you actually are stealing it either from the environment or from something else, because increasing water use efficiency does not make it rain.

There were debates around in South Australia and in this parliament about how to make it rain but until you make it rain you cannot increase water use efficiency and find some free water. There ain't free water there. This is very important and very fundamental.

Interestingly, in America when they started setting up property rights in water they defined water use so you could only trade and sell the amount you consumed, the amount you evaporated and transpired, because if you did that you were not stealing from somebody else. In America they have class actions and third party interests are properly managed and accounted for. This means that the downstream people can take action to stop ministers signing licences and approving trades that create such problems.

In Australia we do not do that, so if we go and buy up water from irrigators at the moment, and they respond by doing the smart thing which is to increase the efficiency of their irrigation, it is quite possible you would end up with less not more water in the River Murray. I will repeat that: you could buy up water in the River Murray and end up with less, not more, water in the River Murray. That is a very important consideration that needs very careful thought. Unless you define water rights in a way that only makes the amount you consume tradeable, you can end up in big trouble.

Land use change is another very important issue, and I promised to come back, to talk about this. The line in green is the amount of water which is evapo-transpirated under trees. Along the bottom here you have annual rainfall and the quantity that is evapo-transpirated, the amount that goes up into the air or is carted out. The line in red is what happens if you have pasture and grass. The difference between the two at the moment currently flows through into irrigation systems. Once again, this is basic hydrology. If you go into an area which is under pasture, particularly in a high rainfall area, and you plant it back to trees you lose a lot of water, a huge amount of water.

We are currently using taxation incentives encourage people to plant trees in the top of the River Murray Basin, to drive it. The bad news from that is that every time you plant a hectare of trees you take water out of the river system. This means, if you understand the hydrology, that you either tell all of the water users that they then have to have a claw-back on their water because now less water is available or you have to make the people who plant the trees buy back the water because it has been allocated to somebody else. It is a choice for government which way you do it, but, whichever way you do it, if the system is to be robust you must tell people and make sure they understand that every hectare of trees that is planted means that less water will be available for irrigation.

It is unavoidable, but a robust solution puts that issue on the table transparently and honestly and does not hide it. The value of water which is being lost as a result of tree planting in Australia is in billions of dollars, and we do not have flows going out the end of the River

Murray now. Every tree we plant makes it harder to fix the problem. It might solve other problems, but unless we get a debit and a credit accounting system that is honest and transparent we will have something that will not work.

So we have talked about return flows and forestry, and let me summarise that. Effectively, if you are going to define entitlements you must define them in net, not gross, terms. It is a bit like telling Mike Young in CSIRO that I do not have to worry about the cost side of the equation because somebody else is going to do that. If you understand the net bottom line then it is the net bottom line that matters, and if you manage that, as companies worked out years ago, things work out in the long run. That means that the amount of water that is consumed, not the amount of water that is pumped, is what really matters. There could be some real irrigation efficiencies but they come from being super smart, not just cheating on your neighbours.

If we set up a system which links into land use change, then those who reduce recharge by trading or by actually increasing water use efficiency are going to have to account for that, and the accounting system is going to show how that is done. If you do that, the only way I can think to do it is if somebody is going to have to buy back the reduction or else claw it back in some way. If you do not do that you will end up in trouble.

It also means that all the allocation systems must deem the amount of water that is being used. If somebody uses only half of the amount, it is very important to tell them that, so that they only expect to trade half of it. If you tell them that they have 1 000 megalitres and it is 1 000 megalitres that is there, if you tell them that the price is $1 000, as it is, per 1 000 megalitres and there is a million dollars on your property for every 1 000 megalitres—it is the story we are communicating at the moment—and then you turn up the next day and say, 'I'm sorry, it's only worth half a million,' then I would be pretty shocked.

The irrigators that I have spoken to about this have paled visibly in front of me as I have gone through the story I have just told you about how serious it is, because they suddenly understand that what they thought was worth a million dollars, because we had not specified honestly what was going on, had never communicated this to them, was worth only half a million. To tell somebody in one breath that what they thought was worth one million is worth half a million because of a mistake is not good news, but it is important.

We clearly, as has already been said, have to bring forestry and other significant land use changes into the systems. Similarly, if somebody clears a forest then perhaps they can get credit for the water that is actually returned back to the system. But a robust, sound, sensible system would face this music. I can see some of you smiling and some of you nodding your heads. This is incredibly important. If you want a system that works, the system has to be based, first, on understanding the water cycle and how water flows from where it first forms,

when it first comes down on to the soil and runs through into the rivers and how it goes through into the groundwater and back on down again.

The entitlement and registration and trading side is less controversial, and I want to now expand a little bit on this. I have already said that Torrens has pointed out and demonstrated around the world how powerful guaranteed registration of interests, including those of mortgagors are. It is an incredibly powerful, very simple system, which can be put in place. It requires different legislation.

None of the states which are setting up water registers in Australia has yet been prepared to guarantee them. I ask you why. Why if you set up a system would you not guarantee it, when you have already done it for land and have done it with such power that we have turned it into a big business for Australia, showing people how to set up systems that do not fail? Why can't we do it for water? Clearly, you have to have trading rules and exchange rates which are transparent, open and honest and which are fixed, and you need licensed brokers and you need formal settlement procedures.

Those are all things that were worked out in 1857 in this house of parliament and they have not needed change since. There have been some adaptations. I was in the settlement room last week and I said, 'What's the most significant change that has happened?' They said, 'We don't use the telephone any more because we have mobile phones.' You can imagine that there used to be a bank of telephones for inquiries, but we still have a settlement room and the process still works. It takes an hour a day to settle all of South Australia's trades. They always do it in an hour, and they pride themselves on that. This is an incredibly powerful system.

I now want to talk about entitlement arbitrage. When you set up licensing systems, particularly shonky licensing systems, arbitrage is the name of the game. We have brought water trading in Australia into the system. Smart investors are now buying water, moving it around and positioning themselves to profit from the changes that they know will have to be made. I want to make a couple of observations. Each separate class of entitlement requires an exchange rate and creates an opportunity for arbitrage. The more classes that you put into the system, the more lines that you draw, the greater the opportunity for people to lobby you to change the rules for arbitrage type games. Simpler is often better.

Within each class of share, each entitlement pool, risks are shared. One of the great strengths of the company system is that it actually defined the limits. It said, 'We all know that we are in this together. If something goes wrong because of all those risks, the adaptive risks change, we are in there together and we have worked out in advance how we are going to share that.' There are things like the announcements of profits. It is very important that the dividends are announced and the processes are put in place. The larger the spatial coverage, the less the opportunity for arbitrage. If you have one system for the entire Murray Basin, all the people

within the basin do not have an opportunity, because they share the fate of the basin collectively.

If you have a South Australian system, a New South Wales system, an ACT system and a Victorian system, then there are arbitrage opportunities across each border, and we lobby and try to fight. There are opportunities to go to very big systems with care and with courage. If you do that, you share the risks and we are in there together. The more types of water under the one umbrella, similarly the lower the risk. If you link groundwater and surface water systems together, once again you lower the risks and share the responsibility. These are important issues to think about.

Let me now talk about the second part of the three pillars that I want to run through with you. I think you need to learn about allocations from commerce. The commercial system, as has already been pointed out, understood double entry accounting (debits and credits) and still does. The real advantage is the low transaction costs. Water trades in Australia cost $200 or $300, up to $1 000, or even more depending on what you are doing. The banks can do it for almost nothing because they have designed systems that are robust.

Allocations or the quantity of water that you have to use this year do not have to be linked to the entitlement system. The reason you have what is called a temporary trade is because you have your bucket of water—or in this case a glass of water. If I want to give this water to someone else I have to pick it up and carry it across and put it down. 'Will you please take the glass off?' That is a temporary trade. My entitlement comes back, it is now back with me. It is called 'temporary' because I was not allowed to pass the glass of water over. Instead, I transfer the licence over and someone else takes it off and then brings it back. That is why it is called 'temporary'.

Banks worked out centuries ago that you do not do that, you just pass the water across. Doing it with a complicated system is not state-of-the-art technology. If you manage a pool of water in the same way as you manage pools of money—you don't label them, you realise that you can't write a name on each element or molecule of water, you are in a much more sophisticated system. We still pretend that we name all molecules in the river—that is why it is a temporary trade. We do not need to do that any more. If you manage money with an account that looks like this, anyone can look it up and see how much is their water as they go through. There is an allocation based on the number of shares they have in the amount that is consumed. It is credited to their account at the start and a transfer is written. It is credited into the system. If you use some water it is debited in terms of the quantity that is consumed not the amount that is pumped. If there is an electronic trade it is done in the same way and we go on through.

If at the end some water flows out of the system and you chose not to sell it, that is also taken out of the system. it is very simple and very obvious. It should be possible to write a water cheque. The technology was worked out a long time ago. It is low-cost and it is simple. Similarly, Australia now has B-Pay for banking. There is no reason why we could not have W-Pay for water. The technology exists, it is low-cost. If the aim is to get the markets to solve the problems that we have, we should at least bring the technology that we know works, off the shelf—it is available off the shelf—and use it.

The last thing I want to talk about is the use licence. How do we use water? So far, all I have talked about is where water is and who has the right to receive allocations, not actually how you authorise people to put water on the land: to irrigators, to use it in factories, to consume it. This is the third issue. Use is much like a permission, a development approval. What matters is how you use water and what practices you adopt. It is about placing conditions on irrigation. This is to be separate from the allocation bit so that we can manage the environmental problems associated with water use without having to argue about whose share it is and how the allocation system works. That can be put aside so that when we debate the environmental side of water use we do not all the time have to go back into the allocation system about fairness in terms of volumes, and we are not tempted to try to use water allocations as a backdoor way of solving an environmental problem. This was worked out when we handed out the Nobel Prize for economics: as soon as you start doing that it becomes shonky and it keeps on falling over and governments keep tying themselves in knots rather than advancing forward.

So, what you do is, instead of having an irrigation licence which says that you have a licence to pump, you have a licence that says that you have a licence to irrigate not more than, say, 300 hectares or to pump a certain volume, but you have to get the water from somewhere else. You might hold that in your account, but you keep the two concepts separate. Then, if there is something like a salinity issue or an impact on a neighbour associated with over pumping or drawdown of groundwater, you can solve that problem without having to go back into the wealth side and change that around. Changes need to be made and they need to be adaptive but you only need to adapt the bit that needs adapting not the whole lot. It might also specify that you can only irrigate using drips. Once again, you would expect a licence to show those sorts of things, but that is not part of the allocation system and it is not actually in the entitlement system, you need a separate instrument to do that.

Similarly, regarding obligations to third parties, increasingly, we are seeing salinity emerging as a major issue. Hypothetically this afternoon you faced that in a scenario of what happens when salt starts coming into the system. Salt sends costs downstream. The impact of salinity on downstream irrigators is significant. I wish I had time to show you the cost story of doing that. It is an impact on other irrigators and on urban water users. Once again you need

separate instruments to manage that. Similarly, you need a separate way to manage impacts on the environment. Putting it out and managing it separately makes it much easier to solve.

I suggest to you that, if we go back and look at the way we set up property rights, there are a whole pile of things that have been reserved to the Crown. You would have all seen titles to land and so forth. It would seem to be sensible to reserve the pollution rights back to the Crown and to put on the title: 'We are informing you now that we think that pollution is an issue and if you use water and you pollute we might hold you liable for doing it. It is a risk that you take.' If you want to you can say that it is a risk that the parliament takes but you must make it clear where you come out on the issue because that drives investment.

Second order implementation issues are where I think Australia has got stuck. I have tried to step back from where we are today to show you three fundamental building blocks. There is a lot more detail behind it which sets out this. All of you will receive a copy of this report that we are releasing today. We particularly wanted to release it here, because this is the home of the Torrens title system. The second order implementation issues are about how we define the environment's interest. What I have really tried to show you is that, unless you get the fundamentals right, you will think you have defined the environment's interest but you will not have. There are so many flaws in the system that you will need to go back and revisit it. You will need to work out how and who actually plans and manages, and all the administrative arrangements associated with it. But the vision is clear. Someone needs to work out how to go from the existing property rights framework through into entitlement shares, or whatever you put in place, but that needs to be worked out: how to get from where we are today to where we actually could be if Australia decides to put on the world's best system, and something that will take us forward.

I think we can do that. The good news is that the arrangements in place in most states are not that far from doing what I am talking about. You need to work out how you are going to define allocations periodically and the time they actually remain alive until they become extinguished. Once again, an important issue, but it is a second order issue. We need to establish clean, low-cost registration and trading systems to set up the guarantees and get that right, but that is not nearly as important as agreeing to get the fundamentals right. The fundamentals are what have to be right. If the basic building blocks are there, you will have something like this house of parliament, which you would expect still to be around for centuries.

You will have to work out how to issue the licences and how to communicate now that there are separate rules about use of water from the entitlements, and put that altogether. All that is possible but it is second order: the vision is what is needed. If we have a robust system, we might have a robust solution. I started this talk with a summary of where Australia had gone, where it started off with COAG saying that we need to separate land and water

rights. In the simple plan to do that, they (COAG) forgot about moving from new system back to old system and nobody debated why you would go back to an old system arrangement, but we did. We have talked about tradeable rights and prices. What we never did and what I have focused on today is talking about how you go about separating that.

I would suggest that, if you want tradeable rights to work through time, you must have entitlement shares specified as one instrument; you must have bank-like allocation systems that are low cost and understand that you are managing a pool resource (pool resource management technology around the world is incredibly advanced; we just need to bring it into water management); and you will need to have use licences that state the limits on the amount of water that can be used, where it can be applied and what the obligations are.

If you go to a system like that, you could lead Australia into offering a service to the world in showing people how to manage water resources and at the same time simplify your agenda and get into the basics of managing water for the future of Australia by putting down some foundations that might last for a very long time. I would like to say 'forever', but I would at least like to hear someone in parliament stand up and say, 'I think the system we are about to put in place will last for a century.' Thank you very much.

MR KOUTSANTONIS (South Australia): I think that what you have shown us today is very exciting, but I am just wondering how this deals with modern farming techniques. Given genetically modified foods and advances in technology, often farmers now are changing crops. If you traditionally use your land for wheat or barley and you want to change it, how would your system or a system that we develop be able to meet changes to farming? If weather conditions are changing and we have to look to different types of crops, can a system like this take that sort of rapid change in which we have to move very quickly?

PROFESSOR MIKE YOUNG: Yes, it can. Sometimes you might need to change the use licence, but you would only change the use licence part, not the rest. If there is a surprising new invention, if someone works out a way to apply water which has never been thought of and which creates environmental problems, the separation arrangement means that you only have to change the conditions pertaining to use, not the entitlement and not the allocation system. That is the strength of this system. We can expect people to come up with new practices and extremely innovative ways to do it. That is a use issue, and what I am saying is that you have to have a system for managing use separately from allocations and separately from entitlements.

HON. DUNCAN KERR (Commonwealth): How do you deal with the problem of assertions of entitlement that are not based in law? This is an abstract and theoretical construct starting from scratch. The invention of the limited corporation would be a wonderful device,

but don't we already have large amounts of over-allocated resource that people regard as a right for unlimited use for such purposes as they desire?

PROFESSOR MIKE YOUNG: It is exactly that issue that has led us to go back and ask: if you did solve that problem, what would the final system look like? A lot of people around Australia at the moment are doing the equivalent of what fishermen did before they went into share-type management systems. People went out and fished for quota and understood that, if they caught more fish than was profitable in the short term, they would receive a larger allocation. A lot of what is going on today is because people realise that we have an over-allocated system and everyone is arguing over what share of the cake is actually allocated to them. I have shown you how you would go into a framework where, once you have decided for once and for all that this is what it will be, then here it is, so we do not have to have an argument again.

The thing that the companies framework and legislation did was say, 'Here is the mechanism and the process: if you want more, you must buy more shares.' There is no other way to do it, and we will no longer entertain or allow arguments over what is someone else's water. While we do not have a system that adds up to one, we have a problem. There is an issue about how we work out how to move from where we are today through to there.

HON. DUNCAN KERR (Commonwealth): I was just wondering about the theoretical construct. The Torrens lands title did not at, a stroke, write out old title entitlements. What it did was say that henceforth the transfer has to come under a new system. Similarly, the construction of the corporation scheme did not say that limited partnerships or other forms of ownership were invalidated. It created a new system that happened to have transactional efficiencies. So, in a sense it is an apples and oranges sort of comparison. Have you a transactional mechanism for getting from a point that actually requires the destruction of what is asserted to be property entitlements into this system?

PROFESSOR MIKE YOUNG: We are actually foreshadowing a series of reports to flow on, which deal with that very issue, and it is a case by case situation. Because we have literally hundreds of separate licensing systems around Australia, each one has to be dealt with system by system to roll it through into something like this. Yes, there is a lot of detail, and you do need to go through bit by bit. You are so right that the smart way to do it is to set up a framework whereby if you want to trade you have to put it into the new system before you go any further.

It is a very sensible suggestion about how you might roll that conversion process through. Pragmatically, it is likely that you would actually do that. Some systems also roll over very quickly because they are very close to this system; others are a nightmare.

MR TONY WINDSOR (Commonwealth): You have partly answered my question, but just in relation to what you were talking about in water budgeting where you are introducing forestry, are there any statistics indicating the net loss of water to the catchment, first with forestry and secondly with changes such as no till agriculture and the reduced run-off? Are there any statistics there? Secondly, have you seen areas where we can create new water as a result of engineering solutions that will have a degree of magnitude in terms of the Murray-Darling?

PROFESSOR MIKE YOUNG: Yes, there is a small number of calculations, models and data around, as shown on this graph. Certainly, all the points on that graph are data points. This is the best summary of what can be put together. You can see the relationship. It is highly controversial and site specific. The science is not as advanced as people would like it to be, but these data sets are the best around, and there are models trying to understand this as people realise what is going on.

Creating new water might be, for example, by clearing a forest and putting more water into the system. There we have a new technology and a way of doing it. I would be relaxed about someone saying that they are proposing to clear a large state forest, which has been under pine trees. For example, you could say that the most profitable use for the water would be to assign it through the Murray River or into the Darling River. Someone might propose to clear that area and release the water. If they did that they could have shares, because that is a real creation.

If you build a dam you need to be very careful because you are not making any more rain and you not putting more water into the river: all you are doing is changing the time when it flows through. So, it can give you an opportunity to change allocations but the total volume of the water may be the same. If there is economic advantage from managing the released strategy better, then that could happen but you have to be very careful. If you divert water over a range or put it back, as we are trying to organise in the Snowy, we have to get both sides sorted out.

If there is a credit it must be a real credit and there must be more water. The banking system worked this out. The only way in which you can allocate more shares is if you bring in more capital, but it must be more capital—not something which is pretend capital.

MR TONY WINDSOR (Commonwealth): What about a system such as Menindie Lakes where, if we re-engineered the lakes, you would make it deeper and cut down on the evaporation rate? Effectively, in your system that would create more water for the total system, would it not?

PROFESSOR MIKE YOUNG: Yes, if you engineered a lake to stop losses. Another example is if someone invented a film you could float over a dam, which stopped evaporation, that extra water could flow through into the system. There must be a real increase.

MR MITCH WILLIAMS (South Australia): It has been a most interesting discussion. The only reason I am a member of parliament in South Australia is because I represent an area with a system which is purely a ground water system. It does not involve a riverine type system. I believe it is somewhat different from what is happening in other places in Australia, particularly with our major rivers.

Some questions have been asked about forestry. I agree with what you say that we must account for it. We have a huge problem on the ground with practical land managers or farmers. Land use change to forestry is one which water managers have grasped and run with in a significant way in recent years, but there are much more subtle ways of land use change.

For example, if 2 000 farmers each planted 50 hectares of lucerne, I believe that would have the same effect as planting 100 000 hectares of forest. This is the challenge in front of us. The challenge is not accounting for that but, rather, do we tell the farmers they have to stay with today's technology; or will we allow them to move ahead with new technologies and possibly a new genetically modified crop in the future; or do we tell a group of land managers or farmers to stay with today's technologies while the irrigators move on? Can you comment on land use changes other than forestry?

PROFESSOR MIKE YOUNG: I agree. All significant land use changes need to be accounted for. Certainly, lucerne is a classic example. It is almost exactly the same as trees. Trees and lucerne through summer are like a sprinkler. They stand there and all the time pump water out of soil and breathe it up into the air. Most of Australia's grasses are dead in summer and do not transpire, but lucerne, trees and a couple of other crops do. Similarly, if you make a surface impervious and run off all the water, then you have different changes. All the systems have to be accounted for.

It is also very important to design a system that can cope with change. Once again, I think you are right. We have to design a system that works. As we tried to say in the report, and we actually wrote on the South-East, the case is a question which came from the catchment board down there. They said, 'Call your report "who dares wins".' We went to the board and said, 'You have a choice. If you want to fix this, you have to be honest and put these arrangements on the table so everyone understands them, and design a system which can cope with change but which aims to solve the problem forever by designing a system to cope with changing knowledge, you stay in a framework that is consistent with the system itself, with the hydrology.'

In parliament and in the laws of the nation we do not have the power to change how water flows. If you have an allocation system that starts to get out of kilter with what is happening in the real world, sooner or later you end up in strife. I cannot stress too strongly that the world needs a system that has the fundamentals built in, hardwired in, so it works forever.

MR MARK BRINDAL (South Australia): Is that not an element you could further develop? You said one element for each problem. Mr Williams and Mr Koutsantonis talked about land use change. If you built in some sort of insurance component between share entitlement and protection of the watershed—because ministers have to reallocate water; you can only allocate what is there—if you said to people who own a share entitlement, 'You can insure the entitlement by somehow contracting with people who provide watershed, and at the time it needs to be reallocated it would reallocated in accordance with the way in which you have set out to protect your entitlement,' would that be another element that could help?

PROFESSOR MIKE YOUNG: I think the system about which I am talking is one where we bite the bullet to say, 'We will insure the entire catchment.' If we are not prepared do that, the next step is to insure parts of it and gradually roll progressively through a system where it is all insured. An offset framework works. If you can fix up one bit and start trading it off, then you make progress forward. That is a way of going forward, but there are examples around the world where these systems have been tried and what you end up is that the hard bits never get solved.

If you use all the cheap solutions to fix up the cheap problems, you end up with a horrible gap in the end. The challenge is to put in place something that solves it forever, preferably in one hit. If you cannot do that, then to go stepwise through a system where you say, 'Okay, if you want to develop, you have to solve a problem somewhere else,' is a stronger way than standing still. It is an option.

Also, behind this, a lot more detail must be explained. I have tried to keep what I have explained today very simple. Even the report which we are releasing is a high level report. There is a lot more work to be done in terms of the detail, but I sense the idea of having something which is robust, and which you would expect to be robust in 20 or 30 years, is the way we have to start talking about the problem.

MS VINI CICCARELLO (South Australia): On that note we will call an end to the session. I thank Mike very much for his help.

[Conference adjourned until Tuesday, 1 October at 9 a.m.]