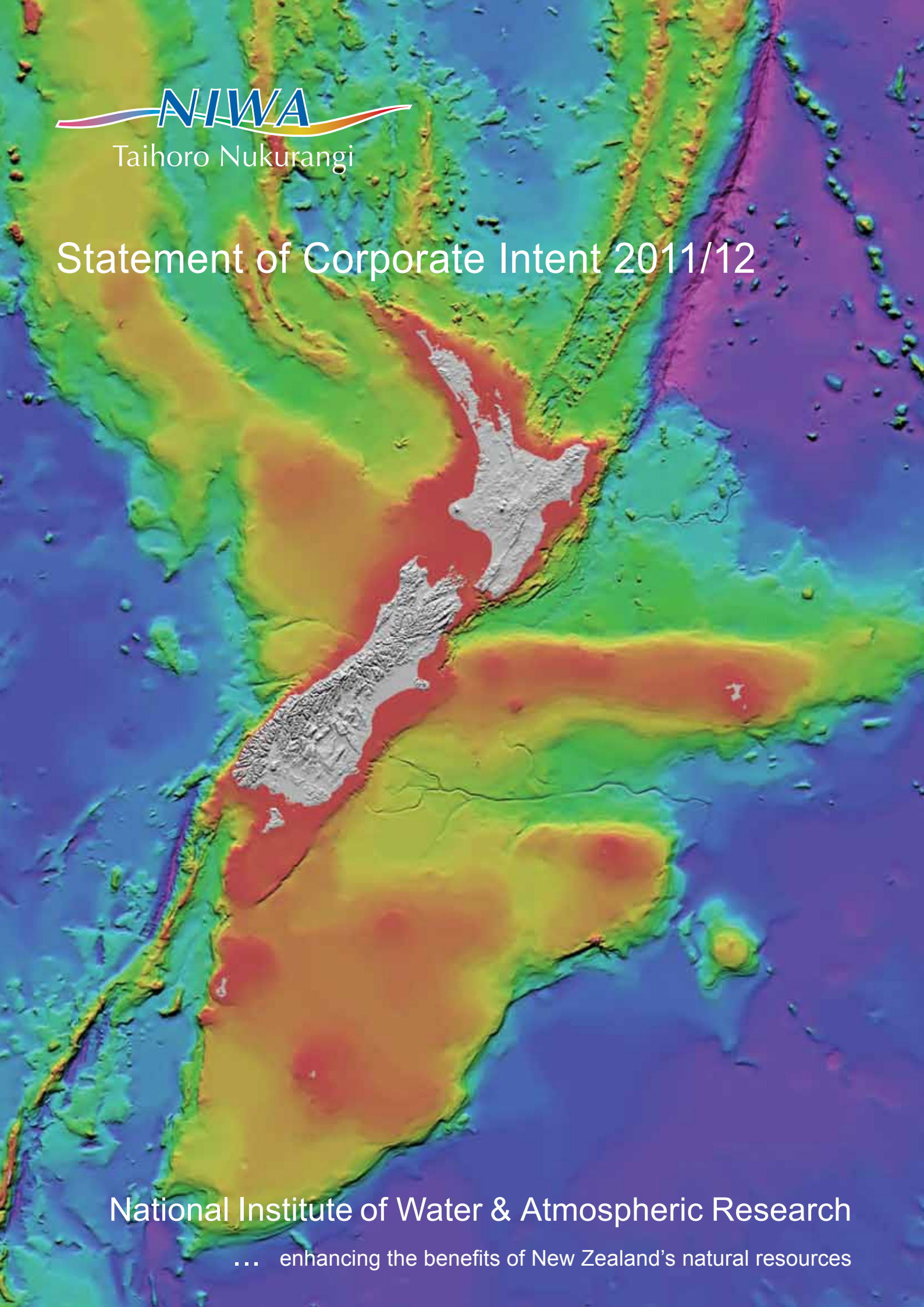


NIWA
Taihoro Nukurangi

Statement of Corporate Intent 2011/12

National Institute of Water & Atmospheric Research

… enhancing the benefits of New Zealand's natural resources

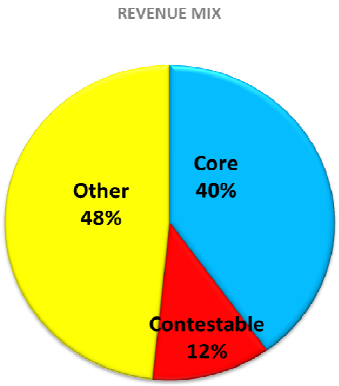
CONTENTS

1 INTRODUCTION

The National Institute of Water and Atmospheric Research Ltd (NIWA) is a Crown Research Institute incorporated as a company on 1 July 1992. Ownership is held equally between two shareholding Ministers appointed by the New Zealand Government who also appoint a Board of Directors to govern the company.

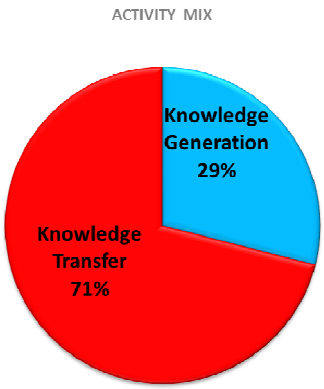
In November 2010 the Government issued a Statement of Core Purpose for each of its Crown Research Institutes that defines their purpose, expected outcomes, scope of operation, and operating principles. This Statement of Corporate Intent (SCI) sets out NIWA's strategy for delivering against its core purpose over the next five years. The SCI is reviewable annually.

NIWA is New Zealand's leading provider of atmospheric, freshwater and marine research and associated services. NIWA currently employs c. 700 staff spread across 15 locations (with major sites located at Auckland, Hamilton, Wellington and Christchurch), has assets of $127M and annual revenues of approximately $120M. Revenue comprises Core Funding, contestable science funding from the Ministry of Science & Innovation, and other funding received through the provision of applied science services to a diverse array of clients. Science assets that are of national benefit include research vessels, a high performance computer, a large-scale aquaculture facility and national measurement networks for climate and water resources.



NIWA's skills and assets are deployed to conduct science that supports New Zealand's economic growth, enhances human well-being, and enables environmental stewardship of the country's natural resources. These benefits are achieved through collaboration with other science organisations and the transferring of knowledge to end-users of our science.

Strategic partnerships with end-users ensure both the relevance of NIWA's science programmes and the use of knowledge transfer mechanisms that will encourage uptake. Further strengthening of these relationships will provide further national benefit, particularly where it is directed towards business sectors that utilize natural resources or are weather-dependent. This SCI continues the shift in NIWA's science activities towards knowledge transfer that was begun in 2010/11 in response to the recommendations of the Crown Research Institutes Taskforce.



1.1. NIWA'S STATEMENT OF CORE PURPOSE

PURPOSE

NIWA's purpose is to enhance the economic value and sustainable management of New Zealand's aquatic resources and environments, to provide understanding of climate and the atmosphere and increase resilience to weather and climate hazards to improve safety and wellbeing of New Zealanders.

OUTCOMES

NIWA will fulfil its purpose through the provision of research and transfer of technology and knowledge in partnership with key stakeholders including industry, government and Māori to:

- increase economic growth through the sustainable management and use of aquatic resources
- grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources
- increase the resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, floods and sea level change
- enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants
- enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity
- increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

SCOPE OF OPERATION

To achieve these outcomes, NIWA is the lead CRI in the following areas:

- aquatic resources and environments (with a focus on surface freshwaters and coastal environments)
- oceans
- freshwater and marine fisheries
- aquaculture
- climate and atmosphere
- climate and weather hazards
- aquatic and atmospheric-based energy resources
- aquatic biodiversity (including biosystematics) and biosecurity

NIWA will work with other research providers and end-users to contribute to the development of the following areas:

- biosecurity, freshwater and hazards management
- climate change adaptation and mitigation
- ocean floor exploration
- seafood sector
- urban environments
- Antarctica.

OPERATING PRINCIPLES

NIWA will:

- operate in accordance with a Statement of Corporate Intent and business plan that describes how NIWA will deliver against this Statement of Core Purpose, and describes what the shareholders will receive for their investment
- meet its obligations as a Crown Company and remain financially viable, delivering an appropriate rate of return on equity
- develop strong, long-term partnerships with key stakeholders, including industry, government and Māori and work with them to set research priorities that are well linked to the needs and potential of its end-users
- maintain a balance of research that provides for both the near-term requirements of its sectors and demonstrates vision for their longer-term benefit
- transfer technology and knowledge from domestic and international sources to key New Zealand stakeholders, including industry, government and Māori
- develop collaborative relationships with other CRIs, universities and other research institutions (within New Zealand and internationally) to form the best teams to deliver its core purpose
- provide advice on matters of its expertise to the Crown
- represent New Zealand's interests on behalf of the Crown through contribution to science diplomacy and international scientific issues and/or bodies as required
- seek advice from scientific and user advisory panels to help ensure the quality and relevance of its research
- establish policies, practices and culture that optimise talent recruitment and retention
- enable the innovation potential of Māori knowledge, resources and people
- maintain its databases, collections and infrastructure and manage the scientific and research data it generates in a sustainable manner, providing appropriate access and maximising the reusability of data sets
- seek shareholder consent for significant activity beyond its scope of operation.

1.2. OPERATING ENVIRONMENT

This SCI has been prepared within the context of:

- increased clarity about the purpose and expectations of Crown Research Institutes
- increasing challenges posed by the fiscal environment in which NIWA will operate
- increasing opportunity for the science capability that NIWA has to add value to New Zealand

CLARITY OF PURPOSE – BEING RELEVANT TO STAKEHOLDER NEED

The Shareholders' expectations are clear – investment in science and innovation must deliver more value to New Zealanders by making a greater contribution to economic and environmental prosperity.

In particular, stakeholders and end-users expect NIWA to deploy its scientific resources to enhance the economic social and environmental benefits derived from New Zealand's natural resources by helping meet the following needs:

- More efficient use of water.
- Managing water quality better.
- Reducing risks from weather-related hazards and climate change.
- Meeting future energy demand through renewable resources.
- Improving economic returns from fisheries and aquaculture.
- Enhancing stewardship of New Zealand's biodiversity.
- Reducing impacts of aquatic pests.
- Extracting seafloor resources in a manner that minimizes environmental risk.
- Optimising use of natural resources through better access to environmental data.

Section 2 in this SCI describes how NIWA will meet these needs through aligning its science programmes, infrastructure, collaborations and technology transfer mechanisms.

CHALLENGING FISCAL ENVIRONMENT

The fiscal environment over the next five years will be challenging and, in developing our science strategies and associated financial forecasts presented in this SCI, we have assumed the following:

- The global recessionary environment will continue into 2011/12 and New Zealand's economic recovery will be slow[1].
- Pressure on government department budgets will remain and this will limit or further reduce their spending on external science services and advice.

[1]Source: Treasury economic forecast post the February earthquake, Treasury's February Monthly Economic Indicators.

- Government investment in Vote Science will remain static in the short-term but show some increase as the economy recovers.
- Private sector investment in science and innovation will show some growth in response to an improving regulatory and tax environment for business, increased government support for industry-led innovation, and increased foreign investment in New Zealand's primary sector as the global economy recovers.

ENHANCED VALUE FROM NIWA'S SCIENCE

Science and innovation is one of six key drivers in the Government's Economic Growth Agenda. For this to be given effect will require science to have more input to public policy formulation and be increasingly integrated into the decisions and operations of businesses. Key opportunities for enhanced value from NIWA's science can be viewed within the following context:

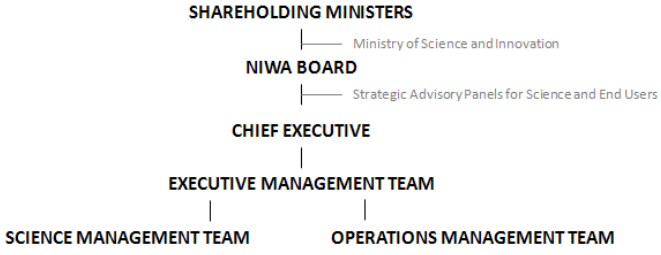
- Global issues around food, energy and water will intensify over the next five years, providing New Zealand with opportunities for economic growth.
- While New Zealand has abundant natural resources, our public policy with respect to utilising these assets is often not well-founded on knowledge of the resources.
- The process for developing public policy is now shifting towards one that is more evidence-based and receptive to science input (e.g., the recent Land & Water Forum process).
- As environmental limits on natural resource use are approached, more efficient use of those resources to maximise economic return becomes a priority.
- Much of New Zealand's economic wealth is based around climate- and weather-sensitive primary production sectors.
- Approximately two-thirds of the electricity needed to fuel our economy is derived from renewable sources that are weather-sensitive (hydro and wind).

In response to this context, NIWA will increasingly re-position and re-deploy our skills and assets to enhance our contributions to public policy and to work alongside businesses to improve their profitability. Section 2 describes the details of how we plan to do that.

1.3. ALIGNING THE ORGANISATION TO DELIVER ON CORE PURPOSE

ORGANISATIONAL STRUCTURE

NIWA's organisational structure from July 1 2011 is shown in the diagram below.



Key points are:

- Science and knowledge transfer strategies are driven by the Science Management Team, led by the General Managers of Strategy and Research. In response to the CRI Taskforce recommendations, the Science Management Team now includes:
  - A Manager, Marketing and Sector Engagement with a pan-NIWA responsibility to enhance engagement with industry.
  - A Chief Scientist, Environmental Information with a pan-NIWA responsibility for improving the curation and accessibility of data for re-use and value creation.
- Science planning is important to delivering on our strategy, but these planning processes must remain flexible and nimble to seize new opportunities for science innovation, sector engagement and knowledge transfer.
- Operational Delivery of the science is driven by the Operations Management Team, led by the General Manager, Operations. This team is responsible for assembling the best teams for projects and ensuring milestones are met on-time and within budget.
- Support functions are led by appropriate General Managers and the Chief Financial Officer and are focussed on providing cost-effective support for scientists and for ensuring compliance and reporting requirements are met.
- Strategic Scientific and User Advisory Panels will play key roles in providing independent and forward looking advice to the NIWA Board on research strategies, user relevance and knowledge transfer activities. The Board will establish the initial membership of these panels by July 2011 and receive their first reports by November 2011, ahead of the next SCI planning process.

NATIONAL SCIENCE INFRASTRUCTURE

Much of NIWA's science is capital intensive, requiring on-going investment in scientific equipment that enables new insights to be gained and applied. Over the past two years NIWA has invested $52M in capital assets, principally large-scale science infrastructure that enables delivery of our strategic objectives, including providing greater opportunities for science collaboration and enhancing benefits to stakeholders. Key national science infrastructure investments include:

- Purchase of a replacement High Performance Computer to advance climate change modelling and weather-related hazard and energy forecasting. NIWA purchased excess capacity (and the ability to increase capacity at low cost), as a cost-efficient means for other New Zealand researchers to access the computer's capabilities through the National eScience Infrastructure (NeSI) collaborative initiative.
- Large scale refit of NIWA's research vessel Tangaroa, including installation of a dynamic positioning system that has broadened the vessel's capabilities. These improvements now allow major advances to be made in determining the resources that lie within New Zealand's Exclusive Economic Zone.
- Continued investment in the Bream Bay Aquaculture Facility to advance aquaculture R&D. This facility is now well-equipped to be utilized by the aquaculture sector over the next five years as it seeks to uptake and commercialise finfish opportunities arising from our R&D.

- Upgrades to the infrastructure that supports NIWA's national monitoring networks for climate and river flows. When combined with current improvements to our website, this will enable others to better access and re-use NIWA's data.

This SCI assumes lower levels of capital investment over the next 5 years, with $10M planned in 2011/12. This expenditure will be focussed on new and replacement items needed to deliver on our core science programmes. We are open to participating in collaborative purchase of national science assets or to public-private partnering where these contribute to meeting the strategies outlined in this SCI and result in more efficient use of capital.

STRENGTHENING OUR RELATIONSHIPS

Effective delivery of core purpose outcomes will require strong and enduring relationships with other research institutions (within New Zealand and internationally), industry, local and central government and Maori. There is a need to shift from transactional relationships to deeper partnering arrangements with key collaborators and stakeholders. In doing so we will:

- Maintain and build upon the over 1,000 science collaborations we already have within New Zealand and across the globe to ensure a 'best-team' approach to our research. We will continue to play a lead role in the New Zealand Climate Change Centre, participate in the freshwater research alliance, collaborate with GNS Science and others in the Hazards Platform and join with Plant & Food Research to develop a seafood research alliance.
- Deepen our high-level strategic relationships with key government and local government agencies so they are able to better inform our science strategies and to uptake our science outputs for public policy development and implementation.
- Further implement our industry sector engagement strategy initiated in 2010/11. This sector engagement strategy is focussed on developing a better understanding of their vision and helping them achieve that through appropriately targeted research and application of our science capabilities.
- Strengthen collaborations with Universities to ensure future capability is being developed in areas relevant to NIWA's science strategy. In 2011/12, particular focus will be placed on establishing a Joint Graduate School in Coastal and Marine Science with the University of Auckland.
- Continue our Maori engagement through the efforts of our Te Kuwaha team (see section 2.11).

Section 2 describes the key science collaborations and stakeholder engagements within each of our National Science Centres.

2 NIWA'S SCIENCE AND KNOWLEDGE TRANSFER

THE STRATEGY PROCESS

To deliver on our Statement of Core Purpose, NIWA's research and knowledge transfer activities are organised through 13 National Science Centres that are aligned to industry and/or resource sectors. These virtual Centres are led by Chief Scientists and Centre Management Teams comprising our leading scientists.

Each Centre Management Team is responsible for ensuring development and delivery of Centre Science Plans that seamlessly link research and knowledge transfer to best meet national benefit outcomes by:

- Taking into account NIWA's Statement of Core Purpose and the high level strategic directions and priorities for NIWA agreed between the Board and Executive (in future years these high level strategic directions will be informed by advice from Strategic Science and User Advisory Panels).
- Engaging with end-users to ensure their needs on specific issues are understood and taken into account. This includes agreeing with end-users on the best mechanisms for knowledge transfer.
- Developing science programmes with science staff and recommending priorities for science investment.
- Forming collaborations and alliances with others to ensure a 'best team' approach to science and its application.

The development of Science Plans takes a holistic view and includes all activities required to deliver core purpose outcomes no matter what the funding source (Core Funding, Contestable Funding, or Other sources). Science Plans are central to NIWA's overall strategic planning process, ensuring that priority science needs drive the functional and infrastructure support needs of the organisation. They are 'living' documents, reviewed on an annual basis.

The following sections provide summaries of these Science Plans and the Table below summarises which outcomes in NIWA's Statement of Core Purpose each National Centre's science programmes are *primarily* aimed at addressing.

The six outcomes outlined in NIWA's Statement of Core Purpose are:

1. increase economic growth through the sustainable management and use of aquatic resources
2. grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources
3. increase the resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, floods and sea level change
4. enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants
5. enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity
6. increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

Centre	Core Purpose Outcome					
	1	2	3	4	5	6
Aquaculture	✔				✔	
Fisheries	✔				✔	✔
Oceans	✔			✔	✔	✔
Coasts				✔	✔	✔
Freshwater	✔	✔	✔	✔	✔	
Biodiversity and Biosecurity	✔				✔	
Hazards			✔			
Energy		✔				
Climate		✔	✔	✔		✔
Atmosphere				✔		
Environmental Information	✔	✔	✔	✔	✔	
Te Kūwaha	✔		✔		✔	
Pacific Rim	✔	✔	✔			

The process by which Science Plans are developed is also integral to NIWA's investment of Core Funding under the new funding arrangements with the Ministry of Science & Innovation. This is discussed below.

CORE FUNDING INVESTMENT

In response to the CRI Taskforce recommendations, the Ministry of Science & Innovation is currently finalising arrangements with CRIs for the introduction of Core Funding from July 1 2011. This will see a proportion of science investment funds transferred from existing Foundation for Research, Science and Technology administered funding pools to a Core Funding allocation to each CRI. The previous Capability Fund will also be included in the Core Funding allocation. This Core Funding is to be deployed by each CRI to assist in delivery of its core purpose.

In making Core Funding allocations to National Centres and to activities within them, NIWA has included the following considerations:

- Science programmes that have been transferred into Core Funding were funded as a result of a robust investment process run by the Foundation for Research, Science and Technology.
- Nearly all science programmes and associated teams have performed well against Foundation contracts in terms of science quality, outputs and outcomes.
- Existing science investments are founded on stakeholder input to ensure science relevance and these stakeholders have expectations that agreed technology transfer and end-user benefits will be delivered.
- Existing research collaborations (including sub-contracting commitments) have been developed by taking a 'best team' approach.
- Ensuring a 'benefit return' from sunk investment.
- The need for a mix of investments, from near-term to provide benefit now to long-term to provide future benefit.
- The research and knowledge transfer activities in each Science Plan that are funded from other sources.
- The overall balance within each Science Plan between knowledge transfer and research required to continue to 'fuel the knowledge pipeline'.

NIWA's Core Funding for 2011/12 is $42.8M per annum and will be invested in:

- National Centre Science Programmes ($40.8M) comprising:
  - Research by NIWA staff ($20.3M)
  - Research sub-contracted to collaborators, to form best-teams ($3.7M)
  - Knowledge transfer to enhance adoption and delivery of outcomes($16.8M)

- Science Awards that are aimed at keeping NIWA's science capability current and relevant ($2M). These awards, which will be allocated by a competitive application process, include:
  - Research sabbaticals to gain new perspectives for our science.
  - Secondments to stakeholders to better understand their needs and how science is adopted within their organisation.
  - Technical training to keep abreast of new techniques and technology.
  - Visiting experts to transfer knowledge and skills that advance key areas of science.
  - Funding for research on new ideas that do not necessarily align with current strategies or to respond to 'events (e.g., droughts, floods, tsunamis, fish kills, pest invasions).
  - Post-doctorates and PhD's in areas of emerging skill shortage.

The investment of Core Funding across National Centres is summarised in the Table below.

CENTRE	CORE TOTAL ($000)
AQUACULTURE	5,136
FISHERIES	1,469
OCEANS	4,026
COASTS	1,682
FRESHWATER	2,702
BIODIVERSITY AND BIOSECURITY	4,623
HAZARDS	4,361
ENERGY	569
CLIMATE	3,887
ATMOSPHERE	5,712
ENVIRONMENTAL INFORMATION	6,037
TE KŪWAHA-MĀORI ENVIRONMENTAL RESEARCH	469
PACIFIC RIM	180
SCIENCE AWARDS	2,000
TOTAL	**42,854**

Compared to 2010/11, shifts in funding *between* National Science Centres have been small, with the largest increase (c. $500K) in the Fisheries Centre being compensated for by small decreases in several other Centres. This relative stability is to be expected given the decision-making factors described above that place appropriate weight on the robustness of past investment processes involving Foundation review and end user input.

Shifts in funding *within* many of the National Science Centres have been significant. In particular, there is a continuation of the shift in funding from research to knowledge transfer activities that was begun in 2010/11 in response to the CRI Taskforce Report. There was a $1.3M shift in 2010/11 and we plan a further $3.7M shift in 2011/12. This $5M shift represents a re-balancing of 12% of NIWA's Core Funds and is designed to better deliver the outcomes in our Statement of Core Purpose. In particular there are increased resources being applied to:

- Engaging with businesses to better understand their needs and develop tailored products that meet those needs.
- Developing real-time data and forecasting products that enable weather and water dependent sectors to make operational decisions that optimise returns from their assets.
- Creating new tools from NIWA's existing datasets and knowledge that allow users to extract greater value.
- Supporting NIWA's national-scale environmental monitoring networks in the face of rising costs.
- Working with others to develop research strategies for New Zealand's oceans and Antarctica that will provide the science necessary to address key resource management issues.

2.1. AQUACULTURE

Science within this Centre is primarily aimed at addressing the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management and use of aquatic resources
- Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand aquaculture will be a financially and environmentally sustainable billion dollar export industry by 2025 through the production of high value species that meet current and future market demand for products with verifiable provenance of quality and sustainability.

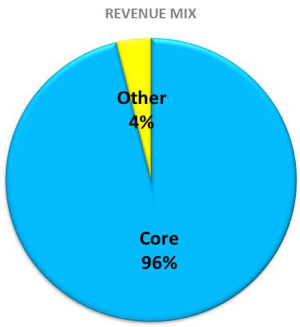
By undertaking the following science programmes:

1. Develop reliable and efficient techniques for the commercial-scale production of high-value aquaculture species.
2. Develop environmental monitoring tools and farm management systems that quantify and minimise the environmental effects of aquaculture.
3. Develop breeding and genetic technologies and apply these to the development of elite stocks that provide the New Zealand industry with sustained competitive advantage.

Sector and government strategies for growth of New Zealand's $300M+ aquaculture industry recognise the economic opportunity offered by diversification into high value species. Achieving such diversification will require that returns are sufficiently high and risks are sufficiently low to encourage the considerable investment required. Our science seeks to provide that investment climate by determining suitable marine space and developing proven production technologies that can provide profitable returns while operating with a low environmental footprint.

INVESTMENT:

NIWA plans to invest c. $25M of its core funding over the next five years to deliver on the science programmes described above and transfer this knowledge to the industry and other stakeholders. Our Bream Bay Aquaculture facility is well-established through previous capital investment. It is anticipated that industry (and suppliers of products to industry) will increasingly invest in our capabilities and take on capital risk as opportunities move from R&D to commercial ventures.



RELEVANCE TO STAKEHOLDERS:

- Growing global demand for seafood, when placed alongside finite wild fisheries resources, means that aquaculture must grow to fill the supply gap.
- Fin-fish aquaculture is an opportunity specifically identified in the Government's Economic Growth Agenda and the new Aquaculture Agency has been formed to develop a National Aquaculture Strategy and implement it.
- Recognition within the sector that growth to a $1B per annum target will require introduction of high value species that offer opportunities for market differentiation and premium branding.
- Current Government initiatives aimed at removing the legislative barriers to accessing marine space for fin-fish farming and resolving outstanding matters under the Maori Commercial Aquaculture Claims Settlement Act are stimulating investor interest, both from within New Zealand and off-shore.
- The start-up of new aquaculture is a high risk activity requiring significant capital investment over extended periods before profitable returns are realised. Good science, at sufficient scale, is required to lower start-up risk and improve return so that investment is encouraged. Reliable access to improved breeding stock and juvenile production technology are key components in assessing any aquaculture venture.
- Communities and consumers are demanding that the environmental footprint of aquaculture is minimised and verifiable. Regulatory and certification bodies need monitoring guidelines to provide that surety and industry are seeking operating guidelines to achieve those expectations.

KEY SCIENCE COLLABORATIONS:

- Seafood research alliance with Plant & Food Research, bringing together NIWA's skills in aquaculture with Plant & Food's skills in post-harvest processing technologies and sensory evaluation.
- University of Auckland, through the Joint Graduate School in Coastal & Marine Science, to ensure building of New Zealand's science capacity to meet the future needs of the sector.
- AgResearch for specialist capabilities in high throughput genetic analysis to inform our selective breeding programmes.
- Research institutes in China, Canada, Norway, Scotland, and Australia with expertise in aquaculture and mitigating its environmental effects.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Work collaboratively with industry to conduct joint trials of new species, improving efficiency of production from existing species and developing techniques for reducing the environmental footprint of marine farming.
- Conduct R&D sponsored by feed manufacturers and or ingredient producers for development of new finfish diets.
- Continue to describe the economic opportunities to be derived from environmentally-sustainable aquaculture to appropriate government and regional economic development agencies. Work with the Ministry of Fisheries Aquaculture Unit and Regional Authorities to determine those areas of marine space most suited to aquaculture and the monitoring protocols required to gain assurance that environmental limits are not being exceeded.
- Present business opportunities for finfish aquaculture to existing industry players, new investors (including foreign investors) and their financial advisors.
- Participate, as appropriate, in public-private partnerships that assist in establishing new species aquaculture in New Zealand, including access to intellectual property, infrastructure to grow fingerlings and develop elite broodstock for start-up ventures.
- Work with industry, national and international agencies to develop appropriate environmental certification standards for aquaculture products, with a focus on fin-fish farming.

IMPACT MEASURES:

1. Increased industry farming of new species fin-fish, both in existing and new marine space..
2. The environmental footprint of marine farming activities has been minimised and, as a result, New Zealand's aquaculture products meet eco-certification criteria and receive a price premium.

KEY PERFORMANCE INDICATORS:

1. Develop a practical hapuku-specific diet by July 2012.
2. Prototype juvenile production system and associated manual for the farming of hapuku developed by December 2012.
3. Sediment profile imagery has been evaluated as a cost effective and ecologically relevant methodology for the benthic monitoring of aquaculture's footprint by 2013.
4. Spawning of genetically diverse brood-stock to produce multiple families and evaluation of commercially valuable traits for hapuku and kingfish completed by 2013.
5. Elite breeding stock has led to a demonstrated increase in productivity for at least one aquaculture species by 2014.
6. Preliminary models and field trials of Integrated Multi-Trophic Aquaculture species established by 2015.

2.2. FISHERIES

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management and use of aquatic resources.
- Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity.
- Increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand maximises long-term economic benefit from its fisheries through a science based management system, accepted as international best practice, and high value products.

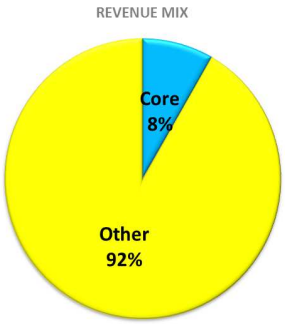
By undertaking the following science programmes:

1. Develop and apply standardised stock monitoring and assessment methodologies for New Zealand's deepwater, inshore and freshwater fisheries to enable monitoring and prediction of changes in fish population biology, fish stock biomass, and size and age composition.
2. Develop and apply standardised methodologies to monitor and assess international fisheries outside the New Zealand EEZ and determine the environmental effects of fishing.
3. Determine the impact of fisheries on the aquatic environment to inform an ecosystem-based approach to fisheries management and development of potential mitigation measures.
4. Enhance the value of wild fisheries products through improved fishing practice.

New Zealand's fishing industry currently exports $1.4 billion of product, and our Quota Management System (QMS) is considered one of the best in the world. Stock monitoring and assessment for species under the QMS is essential, not only to maximise catch but to meet the growing international market need for products from sustainably fished stocks. There is also a growing consumer demand globally for reducing the environmental footprint along the entire fish supply chain. Our science will aim to grow the economic returns from our wild fisheries through both sound stock and environmental management, and improved product attributes.

INVESTMENT:

NIWA plans to invest c. $7M of its core funding over the next five years on research to help deliver on the above science programmes and transfer this knowledge to stakeholders. Most of the funding in this Centre is derived from the Ministry of Fisheries, to deliver assessments of stock and understanding of the effects of fishing. This Centre depends on the specialist capabilities of NIWA's vessels and associated acoustic equipment.



RELEVANCE TO STAKEHOLDERS:

- Ministry of Fisheries, fishing industry, and Māori objectives for managing and exploiting New Zealand fisheries resources require ongoing robust monitoring and assessment of fish stocks.
- Objectives of the Department of Conservation and environmental non-governmental organisations to manage and mitigate the impacts of fishing on non-target species and the aquatic environment.
- Recognition that research is needed to support single-species management of the 96 species (628 fish stocks) under the Quota Management System (QMS), with a focus on key species.
- Meeting International obligations under various agreements (e.g., United Nations Convention on the Law of the Sea, Convention on the Conservation of Antarctic Marine Living Resources, Convention on Biodiversity, South Pacific Regional Fisheries Management Organisation, Western and Central Pacific Fisheries Commission, Convention for the Conservation of Southern Bluefin Tuna).
- Sourcing, by large international consumer companies, of commodities that have been sustainably produced to meet growing global market demands for improved environmental performance of food supply chains.

KEY SCIENCE COLLABORATIONS:

- Researchers in New Zealand and overseas who have specialist expertise related to fisheries monitoring, population modelling, effects of fishing and ecosystem modelling research.
- Partnership with management agencies, especially the Ministry of Fisheries, fishing companies and Māori, to ensure our research continues to add value.
- Research organisations active in Antarctic and Pacific marine research.
- Plant & Food Research with expertise in post-harvest seafood quality.
- University of Auckland, through the Joint Graduate School in Coastal & Marine Science, to ensure building of New Zealand's science capacity to meet the future needs of the sector.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Conduct annual surveys, characterisations, analyses, and assessments for the Ministry of Fisheries, Department of Conservation, Ministry of Foreign Affairs and Trade, industry, and Māori.
- Present the results to stakeholder Working Groups, at international fora and in research reports.
- Present business opportunities for improving fisheries performance to the Ministry of Fisheries, industry, recreationalists and Māori.
- Direct engagement with the fishing industry to better understand needs and develop solutions that deliver financial benefits.

IMPACT MEASURES:

1. New Zealand fisheries continue to be recognised internationally as well managed and sustainably used.
2. New Zealand seafood products based on the wild fisheries secure premium markets through meeting environmental certification requirements.

KEY PERFORMANCE INDICATORS:

1. Tools and techniques for advancing cost-effective stock assessments have been developed by July 2012.
2. New knowledge of natural and human impacts on coastal fisheries has been acquired to aid future fisheries management by 2015.
3. The cost effectiveness of fisheries operations have been enhanced through new partnerships with fishing companies and Māori by 2014.

2.3. OCEANS

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management and use of aquatic resources.
- Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity.
- Increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand enhances the value derived from its marine resources in a way that maintains both the environmental health of the oceans and reconciles the needs of all stakeholders.

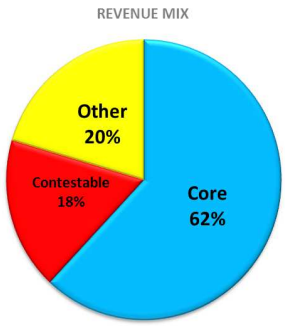
By undertaking the following science programmes:

1. Discovery, survey and assessment of New Zealand's ocean resources and knowledge of their dynamics.
2. Development of the knowledge and tools required to enable an ecosystem based approach to the management and use of ocean resources.
3. Predicting the impacts of global environmental variability and change on ocean resources.

New Zealand's Exclusive Economic Zone and Legal Continental Shelf collectively cover 5.7 million square kilometres of ocean, over 20 times the land area. Our maritime region has a complex seabed, crosses major ocean currents and water masses, and supports a globally unique and diverse biota. Substantial areas are still to be explored, yet they contain vast oil, gas, mineral and energy resources, support our wild fisheries and aquaculture, generate natural hazards, and provide for key infrastructure such as cables and pipelines. Our science will aim to grow the economic returns from our ocean resources and inform sound environmental management.

INVESTMENT:

NIWA will invest c. $20M of its core funding over the next five years on research to deliver the above science programmes and transfer knowledge to the industry and other stakeholders. This is supplemented by $1.1M per annum of contestable funding from the Ministry of Science & Innovation and similar levels of funding from a range of other clients. This Centre relies on the specialist capabilities of NIWA's research vessels *Tangaroa*, *Kaharoa*, and *Ikatere*. NIWA will invest in new oceanographic equipment over the next five years.



RELEVANCE TO STAKEHOLDERS:

- The need for survey information that will advance opportunities for industry to explore and use unexploited resources within the Exclusive Economic Zone (e.g., oil and gas, minerals), enable establishment of marine infrastructure (e.g. optical cables, pipelines) and improve maritime safety (e.g., hydrographic mapping) and inform consenting and management agencies.
- New Zealand's requirement to meet obligations associated with ratified international agreements, especially the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), the Convention on Biological Diversity and the International Hydrographic Organisation.

- Industry and management agency needs for tools to mitigate the adverse impacts of resource use on marine species and ecosystems in response to market and societal demand for environmentally sustainable products.
- Enhance New Zealand's international relationships through contribution to international ocean research programmes that aim to determine the role the oceans (especially the Southern Ocean) in global environmental change.
- The need to quantify the impacts of climate change on ocean dynamics to inform long-term development and management of marine biological resources.

KEY SCIENCE COLLABORATIONS:

- International research institutes to advance and complement NIWA's oceanographic research and regional ocean modelling.
- New Zealand universities to build capacity in physical, biological and geological oceanography. This includes through the Joint Graduate School in Marine and Ocean Sciences with the University of Auckland.
- Scripps Institute of Oceanography (US), the University of Washington (US) and CSIRO (Australia) to continue our partnership in the international ocean observing programme Argo.
- The Antarctic Climate and Ecosystem Cooperative Research Centre (Australia), to further Southern Ocean and Antarctic research initiatives.
- Mineral and petroleum companies to advance exploration and development of unexploited resources.
- Government and Crown owned agencies, especially the Ministry of Fisheries, New Zealand Petroleum and Minerals, GNS Science and Land Information New Zealand, to guide development of future management approaches.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- International programme collaborations (e.g SOLAS, IMBER) to deliver response to global oceanographic research priorities.
- Provide marine survey data to New Zealand Petroleum and Minerals databases and consultancy services to assist the activities of exploration companies.
- Contribute to the development by government management agencies of environmental guidelines, risk assessment, polices and regulations to guide future use of marine resources and stewardship.
- Provide information and data to CCAMLR to guide the use of Antarctic marine living resources.
- Publish New Zealand regional maps and charts of ocean characteristics.
- Communicate findings on of the predicted regional impacts of climate change on marine resources via a New Zealand Climate Change Atlas.
- Contribute to the growing global archive of knowledge on the effects of ocean acidification on marine biota, including the Southern Ocean, and provide input into the Intergovernmental Panel on Climate Change Assessment Report #5.

IMPACT MEASURES:

1. Resource exploration has advanced in previously unexplored regions of the New Zealand Exclusive Economic Zone.
2. New Zealand has improved systems for environmental management of marine resource use that are recognised as international best practice.

KEY PERFORMANCE INDICATORS:

1. Ocean Survey 2020 days utilised to map and assess priority ocean resources by July 2012.
2. Geophysical methodologies and protocols for quantifying seafloor geological resources have been developed in collaboration with industry by 2013.
3. NIWA has worked alongside other research organisations and government agencies to develop an Ocean Research Strategy by 2013.
4. Models and systems have been designed to advance an ecosystem based approach to marine resource management by 2014.
5. Research datasets have been collated, quality assured, archived and made available to relevant national and international stakeholders by 2015.
6. Key regions with high potential for oil and mineral exploration have been surveyed in detail and mapped by 2016.

2.4. COASTS

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management and use of aquatic resources.
- Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity.
- Increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand.

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand's estuaries and coasts are wisely used for economic and social benefit and have measurably improved water quality and ecosystem health.

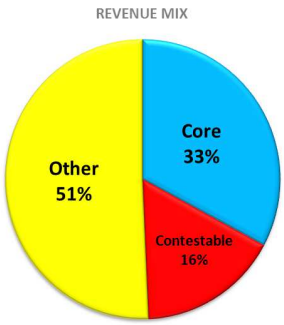
By undertaking the following science programmes:

1. Ecosystems and resources: Develop information and models of coastal ecosystems that improve their management in the face of change.
2. Human impacts: Quantifying and predicting environmental effects of direct coastal disturbances such as discharges, coastal and harbour developments, and mining.
3. Connections to land and oceans: Modelling the connections between coasts, land and oceans to improve both regional land and coastal management and future ocean policy.

New Zealand has approximately 16,000 kilometres of coastline (the 10th longest in the world), with a diverse range of habitats including open coasts, estuaries, harbours, fjords and mangroves. Knowledge of these coastal resources and habitats is patchy. With 75% of New Zealanders living within 10 km of the coast, there are often conflicts associated with the multiple economic and recreational uses to which the zone is put. Our science aims to provide the information and tools needed to balance these resource use conflicts such that economic, social and environmental benefits are realised.

INVESTMENT:

NIWA plans to invest c. $8M of its core funding over the next five years to deliver on science programmes and transfer this knowledge to government, industry and other stakeholders. In addition, funding from the Ministry of Science & Innovation will provide $0.8 M per year for the next three years to cover strategic research on coastal systems. It is anticipated that local, regional and central government and industry will continue to commission applied investigations that use our coastal research capabilities and capital infrastructure.



RELEVANCE TO STAKEHOLDERS:

- The 2010 New Zealand Coastal Policy Statement recognises growing demand to use coastal resources, community desires for water quality improvements, and the looming coastal impacts associated with climate change.
- Development pressures on coastal resources are increasing and there is a need for resource management agencies, developers, and communities of interest to have access to better information and tools to guide consultation and decision-making processes.
- Coastal environments provide key spawning grounds and habitats for juvenile fish and their integrity is therefore important to sustaining fisheries for commercial, recreational and customary harvest.
- Harbours and estuaries are the recipients of land-derived contaminants (sediment, chemicals and microbes). There is a need to better understand the fate of these contaminants and their effects on coastal ecosystems so that appropriate limits can be set and land use controls put in place.
- The effects of climate change on coastal margins (e.g., sea level rise, increased frequency of extreme events) is an emerging issue that will need to be further addressed in coastal planning and infrastructure design.

- The Marine and Coastal Area Act confirms the special interests and legal rights of iwi with respect to the coast.
- The Government's 2010 Antarctic Science Strategy includes marine ecosystems. NIWA research includes areas that will assist the Government's longer term objectives of Antarctic environmental protection.
- Improved monitoring of the state and trends in our coastal waters has been recognised by government with the production of a draft plan (Towards a National Marine Environment Monitoring Programme in New Zealand).

KEY SCIENCE COLLABORATIONS:

- Landcare Research, AgResearch, and ESR for complementary skills in contaminant generation and social and planning dimensions of adapting to climate change. This includes through the Joint Graduate School in Coastal & Marine Science with the University of Auckland.
- New Zealand universities with specialist skills in ecosystem processes and fish ecology.
- International research institutes with expertise in temperate and polar coastal ecosystems, modelling and coastal management.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Continue engagement with representatives from the Department of Conservation, Seafood Industry Council, Ministry of Fisheries, Ministry for the Environment, Auckland Council, and Te Ohu Kaimoana to maintain the relevance of our research and provide advice on appropriate knowledge transfer approaches.
- Build upon our collaborative links with coastal iwi to develop estuarine health monitoring kits and guidelines.
- Provide technical advice to central government agencies as the National Coastal Policy Statement is implemented and as oceans policy is developed.
- Work closely with regional councils to assist with updating and implementing Regional Coastal Plans, resource modelling, planning for coastal effects of climate change, and fit-for-purpose coastal habitat mapping.
- Advise coastal-based industries on options for development of coastal resources, undertake assessments of environmental effects, and provide advice on how effects can be mitigated.

IMPACT MEASURES:

1. The health of coastal ecosystems has improved in response to mitigation measures that limit human impacts in the coastal zone.
2. Improved management of coastal resources has reduced the conflict between the multiple users of coastal and adjacent environments.

KEY PERFORMANCE INDICATORS:

1. Completion, by July 2012, of a hydrodynamic model of the Kaipara Harbour.
2. NIWA's coastal ecosystem indicator model is completed by 2013 and made available to regional councils to assist with estuary management decisions.
3. A model of coastal water quality linking catchment nutrient and sediment inputs to estuaries has been completed and made available to regional councils by 2014.
4. Tools for local coastal adaptation strategies to climate change have been updated by 2015 and made available for adoption by local councils.

2.5. FRESHWATER

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management and use of aquatic resources.
- Grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources.
- Increase the resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, floods and sea level change.
- Enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants.
- Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity.

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand's freshwater resources are wisely utilised for economic benefit and have good water quality and ecosystem health.

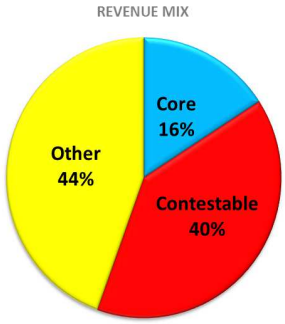
By undertaking the following science programmes:

1. Water resources – Quantifying the hydrological cycle (how much water, where and when) and providing predictions to improve water resource management.
2. Consequences of water use – Documenting and predicting the effects of human use and modification of rivers and groundwater systems to better enable sustainable allocation of water.
3. Water Quality – Quantifying and modelling the sources and consequences of water quality degradation for ecosystem management and human uses of waters.
4. Ensuring ecosystem health – Developing techniques for rehabilitating previously damaged ecosystems and for protecting freshwater values under future economic growth scenarios.

New Zealand's freshwater resources are a key national asset providing significant economic, social, and environmental benefits. Competition for the use of this resource is intensifying, and there is a need to develop new approaches for freshwater management that efficiently allocate the resource and meet societal expectations for water quality and ecosystem health. Our science aims to provide the evidence-base for these new approaches such that economic returns are optimised within environmental constraints.

INVESTMENT:

NIWA will invest $15M of its core funding over the next five years to deliver on the science programmes and transfer this knowledge to industry and other stakeholders. In addition, we expect that contracts from the Ministry of Science & Innovation will continue to provide at least $6.7 M per year for the next five years to cover strategic research on freshwater systems. It is anticipated that local, regional and central government and industry will continue to commission applied research from NIWA to make use of our freshwater research capabilities and capital infrastructure.



RELEVANCE TO STAKEHOLDERS:

- Increased access to water is a key pillar of the government's plan for economic growth but water resources over much of New Zealand will soon be approaching sustainable limits under existing allocation arrangements.
- Growing realisation that future intensification of land use for the benefit of the national economy must occur in a way that does not further degrade water quality and aquatic ecosystems.
- The Report of the Land and Water Forum 2010 stresses the need for "limits, standards and targets" for water quantity and quality to be set with some national consistency.
- There is a growing national desire to rehabilitate degraded freshwater ecosystems, with commitments from central and regional government, industry, iwi, and community groups. There is a need to have science-based rehabilitation techniques so that investment is well-targeted.

KEY SCIENCE COLLABORATIONS:

- Participate in the Freshwater Research Alliance to ensure research activities are complementary and opportunities for collaborative projects are maximised.
- Fellow CRIs with complementary skills in on-land generation of contaminants.
- Universities for work on multiple stressors, water quality, and lake ecosystems and restoration.
- Private research organisations with specialist skills in agricultural water use, groundwater modelling, and flow regime effects on ecosystem health.
- International research institutes with expertise in hydrology, environmental flows, water quality, ecology, catchment modelling, and restoration technology.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Provide technical advice to lead-Ministries developing and implementing new national freshwater policies in response to the recommendations of the Land & Water Forum.
- Work with Ministry for the Environment and Statistics New Zealand on improving national water accounts and State of the Environment reporting.
- Work with the Ministry of Fisheries and iwi fisheries managers on management of freshwater fisheries and on mitigation of land use impacts on coastal fisheries habitats.
- Provide technical advice to regional councils' freshwater policy, planning and management processes.
- Participate with water sector stakeholder groupings in deriving consensus approaches for both assessing impacts of development on water resources and methods for mitigation.
- Work with Maori partners to enhance iwi capability in freshwater health monitoring, and to support co-governance and co-management.
- Continue outreach activities (short courses, field days, 'how-to' guides, workshops, collaborative projects) that help build awareness and skills within district and regional councils, stream care groups and industry sectors.
- Remain involved in central and regional government technical advisory groups that provide direct conduits for knowledge transfer.

IMPACT MEASURES:

1. Increased economic benefit has been derived from use of our water resources within environmental constraints.
2. Implementation of new water policy and rehabilitation techniques has led to a measurable improvement in the quality and ecosystem health of the nation's freshwaters.

KEY PERFORMANCE INDICATORS:

1. Publication by July 2012 of national environmental statistics for water.
2. Methods for determining the cumulative effects of contaminants have been developed by 2013.
3. Tools relating to the monitoring and rehabilitation of freshwaters have been developed and transferred to end users by 2014.
4. Relationships between river flow and ecology incorporated into river management guidelines by 2015.
5. Tools for regional-scale simulation of the effects of water allocation on reliability of supply and their consequences for environmental values are available by 2015.
6. Freshwater ecosystem tipping points quantified by 2015 and available to assist in the setting of water quality standards.

2.6. AQUATIC BIODIVERSITY AND BIOSECURITY

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management and use of aquatic resources
- Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand's environmental management maximises the economic returns from use of its aquatic resources while conserving associated aquatic biodiversity and ecosystems. Biosecurity systems reduce arrival of undesirable aquatic species and those that are here are rapidly detected and their impacts effectively managed.

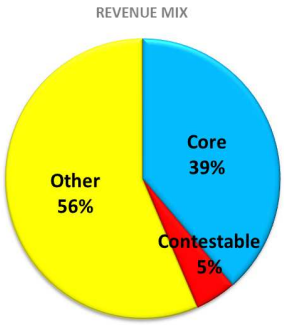
By undertaking the following science programmes:

1. Discover and define the aquatic biota of New Zealand, the Ross Sea region and the Southern Ocean to enable effective resource management and improved biosecurity.
2. Determine the value of New Zealand's aquatic biodiversity, including its roles in ecosystem services, and develop ways to ensure that these values are protected and restored.
3. Identify and evaluate threats to aquatic ecosystems from non-indigenous species, minimise the risk of harmful species establishing, detect and describe aquatic pest populations, and develop tools to mitigate the impacts of non-indigenous species.

New Zealand's long isolation as small islands in a vast ocean has resulted in a unique biodiversity. A high percentage of our species are endemic, including those from our aquatic environments. Defining our marine life is still in a discovery phase, although surveys to date suggest up to 10% of the global marine biodiversity can be found within the New Zealand EEZ. As land-use changes and potential use of ocean resources grows, there is a need to better define our biodiversity to enable appropriate stewardship. The uniqueness of our biota also makes it vulnerable, especially to introduced pests. Biosecurity systems have tended to focus on terrestrial threats, yet marine and freshwater environments and economic activities can also be impacted by the introduction of non-indigenous species. Our science will aim to provide information and tools to aid resource development while providing stewardship of aquatic biodiversity, and to enhance border and post-border control and response to aquatic exotic species.

INVESTMENT:

NIWA plans to invest c. $23M of its core funding over the next five years on targeted research to deliver the science programmes described above and transfer tools and knowledge to stakeholders. NIWA anticipates that regional and central government and industry will continue to commission applied investigations from NIWA that use our biodiversity and biosecurity research capabilities and capital infrastructure.



RELEVANCE TO STAKEHOLDERS:

- Aquatic biodiversity is declining globally and there is an urgent need to identify the current and future (e.g., global environmental change) drivers of this loss to enable development of appropriate conservation measures.
- Recognition that knowledge of the character, distribution and resilience of New Zealand's aquatic habitats is limiting potential use of aquatic resources (e.g., tourism, irrigation, hydroelectric generation, fisheries, aquaculture, and mineral extraction).
- Minimising the threats and impacts of land-use intensification (e.g., urban and coastal development, farming) on aquatic ecosystems and New Zealand's unique indigenous marine and freshwater biota.
- The need for new tools and technologies to help prevent and reduce further harm from indigenous pests and diseases as a result of increased and diversified global trade and travel.
- Meeting New Zealand's obligations to international biodiversity initiatives (e.g., Convention on Biological Diversity, United Nations Law of the Sea, United Nations General Assembly resolutions on protection of vulnerable marine ecosystems)
- The science requirements identified in various government strategies and policies (e.g., the New Zealand Biosecurity Strategy, the National Plan of Action 2010-2035 on Pest Management, the New Zealand Biodiversity Strategy, and the New Zealand Coastal Policy Statement).

KEY SCIENCE COLLABORATIONS:

- National and international research institutes and universities for collaborative development of knowledge and tools for pre-border and border biosecurity, pest management, molecular identification of species, and development of biodiversity metrics and management tools.
- Museum collections and herbaria in New Zealand (including Te Papa Tongarewa), Australia, USA, and London for specialised taxonomic identifications, biosystematics collaboration and accession of specimens.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Provide advice to national and international agencies and aquatic industries, including the International Seabed Authority, Ministry of Fisheries (MFish), Ministry of Agriculture and Forestry (MAF), International Maritime Organisation, FAO, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), the Global Ocean Biodiversity Initiative (GOBI), and seafloor mining industries.
- Provide identification tools and guides (including via web), field identification kits and training workshops on aquatic biota, including non indigenous species.
- Deliver records and maps of species occurrence to central and regional government, industry and the public via a range of digital products, including web portals (e.g. OS2020), the SW Pacific Regional node of the Ocean Biogeographic Information System, the Ministry of Fisheries National Aquatic Biodiversity Information System, and the New Zealand Organisms Register.
- Work with Regional Councils to prioritise habitats for management and conservation and with Maori to identify methods for co-management of resources and restore mahinga kai.
- Contribute to national and regional biodiversity and biosecurity strategic planning including the Biosecurity Science Strategy, Biosecurity Surveillance Strategy and the national Policy Statement on Indigenous Biodiversity.
- Actively participate in collaborative marine pest management partnerships coordinated by the Ministry of Agriculture and Forestry

IMPACT MEASURES:

1. Biodiversity metrics and classifications of New Zealand's aquatic environments are used routinely to identify and conserve representative and unique examples of aquatic communities.
2. Border surveillance and incursion response tools reduce the risks to industry and New Zealand's aquatic ecosystems from the adverse impacts of aquatic pests.

KEY PERFORMANCE INDICATORS:

1. At least two new species identification tools have been developed by July 2012 and old ones have been updated for public use.
2. New knowledge and improved information about the taxonomy and ecology of high priority groups of New Zealand's aquatic biota has been provided to stakeholders through improved delivery systems by 2013.
3. The efficacy of various biodiversity measures as management and conservation tools has been assessed in at least one aquatic location by 2014.
4. Improved techniques for classifying New Zealand marine and freshwater environments to enable identification of conservation priorities by 2015.
5. Generic sampling designs for detection and delimitation surveys of marine pests have been provided to policy makers by 2015.
6. At least one novel method for the control of aquatic pests has been identified and trialled by 2016.

2.7. HAZARDS

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase the resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, floods and sea level change

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand communities will be more resilient to weather driven and marine geological hazards, reducing losses and speeding recovery, now and in an environment that is being modified by both climate and land use changes.

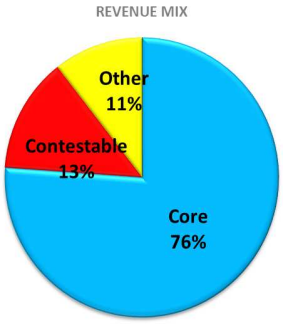
By undertaking the following science programmes:

1. Monitor and quantify weather, coastal and marine geological hazards (including tsunami), providing information on their likelihood to guide design and standards.
2. Understand and model the key processes that influence and determine the predictability of weather related hazards and incorporate them into an operational multi-hazard forecasting system to reduce losses.
3. Evaluate the risk, impacts and potential losses due to weather related hazards to inform planning for mitigation and emergency response.

Our location over an active plate boundary in a windswept ocean in the roaring forties exposes New Zealand to earthquakes, floods, tsunami, landslides, damaging winds and waves, storm-surge and volcanic eruptions. The impact of these hazards on our society and the economy are enormous, and hazard risk continues to increase as the population and infrastructure grows. Our science, in collaboration with others in the Natural Hazards Platform, will provide information and tools to reduce exposure to hazards, and provide timely forecasts to minimise the impacts of extreme events.

INVESTMENT:

NIWA plans to invest c. $20M of its core funding over the next five years on the research and the delivery mechanisms required to inform planners, emergency management stakeholders and weather sensitive sectors. This Centre's activities are also supported by contestable research funds from the Ministry of Science & Innovation and applied research commissioned by weather sensitive industries. We anticipate the latter source of revenue to grow as the full benefits of our forecasting research are taken up by industry. Hazard forecasting is critically dependent on the NIWA High Performance Computing Facility.



RELEVANCE TO STAKEHOLDERS:

- Weather related hazards have high impacts on many sectors of New Zealand, including agriculture, horticulture, transport, energy, search and rescue, and emergency management.
- Legislation and government strategies (e.g., Civil Defence and Emergency Management Act, National Civil Defence and Emergency Management strategy, Resource Management Act) signal a change in hazard response from a reactionary approach to risk assessment and reduction.
- Investment in mitigation and/or planning by central and regional government relies on assessment of the comparative risk of various hazards threats.
- National planning documents (e.g., Ministry for the Environment's Flood Risk Review) call for the ability to mitigate the impacts of future hazards through the application of reliable and accurate forecasts.

KEY SCIENCE COLLABORATIONS:

- Regional councils, port companies and MetService for complementary meteorological and coastal hazard data.
- GNS Science as host of the Hazards Platform, joint venture partners in the RiskScape tool and custodians of the National Seismic Hazard Model.
- The Met Office (United Kingdom) for supply of observations, data assimilation and numerical weather prediction Unified Model codes, collaborative research and development.

- National and international universities and science organisations for coastal processes, risk and flood modelling and uncertainty estimation.
- Engineers and social scientists to provide input on the vulnerability of structures and the direct and indirect hazard impacts and their costs.
- International research programmes on the predictability and societal impacts of weather hazards (e.g., World Meteorological Organisation's weather (THORPEX) and flooding (HEPEX) programmes).

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Provide tools (e.g., HIRDS – High Intensity Rainfall Design System) and information (e.g., frequencies and return periods for floods and coastal inundation) directly to national and local government, businesses, Civil Defence and Emergency Management groups, infrastructure and Lifelines groups, and direct input into design standards (e.g., flood and wind-loading)
- Provide seismic information for the National Seismic Hazard Model.
- Generate and deliver tailored operational forecasts (24 × 7) via the multi-hazards forecasting model system EcoConnect to key business sectors, and provide weather hazards forecasts (wind, rain and snow) to MetService.
- In collaboration with local government, implement and update the RiskScape system. Demonstrate RiskScape to the insurance sector and lifelines and infrastructure agencies.
- Provide input into land-use and resource management plans, policies, regional and national policy statements and national environmental standards through workshops and submissions.
- Apply skills off-shore (particularly to the Pacific Islands) to improve resilience of communities to weather and water-driven hazards (see section 2.12 Pacific Rim).

IMPACT MEASURES:

1. Economic, social and environmental impacts of extreme weather events have been reduced through the application of improved hazard forecasts.
2. Investment in hazard defences has been optimised through quantifying the risks from all natural hazards.

KEY PERFORMANCE INDICATORS:

1. Analysis of damage surveys have been completed by July 2012, and refined hazard exposure, fragility and vulnerability models have been developed and implemented in RiskScape for the significant New Zealand hazards by 2014.
2. An ultra-high resolution weather prediction model has been implemented into the forecast system by July 2012, and integrated with an ultra-high resolution wave prediction model and data assimilating flood prediction model by 2013. These have been used to determine future local-scale event probabilities under a changed climate by 2016.

3. Regional flood frequencies have been updated for each major region of New Zealand on a four yearly cycle, with the first region completed by 2013.
4. Coastal inundation modelling outputs, that include effects due to tides, storm surge, sea-level rise, ocean waves (including tsunami) and river floods, have been developed, validated and implemented in the forecast system by 2016.

2.8. ENERGY

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources.

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand is powered by sustainable and secure energy, optimising renewable and low emissions solutions at national and local levels.

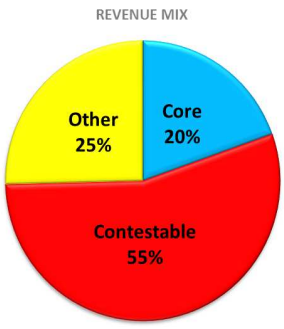
By undertaking the following science programmes:

1. Develop information and tools to implement a wide range of renewable energy solutions.
2. Exploit the energy potential of waste treatment to produce electricity and transport fuels.
3. Predict the renewable energy output and its variability for operations and long term planning for the electricity system.

While New Zealand is rich in renewable energy resources, and unlike most developed countries these resources already meet much of our national energy needs, it has become increasingly reliant on non-renewable fossil fuel sources to meet growing energy demand. Our science will aim to optimise the exploitation and use of New Zealand's renewable aquatic and atmospheric energy resources.

INVESTMENT:

NIWA plans to invest c. $2.5M of core funding over the next five years on the science programmes described above and the transfer of knowledge to energy sector planners and operators. Delivery of these programmes is also reliant on the contestable research funding received from the Ministry of Science & Innovation. We anticipate the energy sector to continue to commission applied science from NIWA and for this to increase as the benefits of advanced forecasting tools become increasingly apparent.



RELEVANCE TO STAKEHOLDERS:

- The government's Energy Strategy (2010) has a strong focus on security of supply to underpin economic growth and performance, creating a need for information on all indigenous resources to secure future energy.
- The government has retained a target of 90% renewable electricity by 2025, driving a need to evaluate renewable resources and understand and mitigate any environmental effects associated with their use.
- The emissions trading scheme (ETS) is designed to reduce greenhouse gas emissions, including those associated with energy production and usage, supporting more renewable options.
- Internationally, new forms of energy supply, such as energy from waste treatment, are developing rapidly. The verifiable sustainable production of waste treatment biofuels make them readily acceptable to New Zealand.
- The increasing proportion of fluctuating renewable electricity, derived from the likes of wind and marine resources, requires improved forecasting of the variable generation sources and transmission/delivery for security of supply.
- In the medium term, there is likely to be an increase in the move to more distributed and localised energy (electricity) production with the uptake of smaller scale solutions.
- Pacific island states, as well as some areas within New Zealand, have quite specific off-grid energy needs that can be supported through better information on energy supply options.

KEY SCIENCE COLLABORATIONS:

- National and international research organisations and universities for marine energy measurement and modelling and energy devices.
- Agricultural based agencies, industries and research organisations for quantifying biogas emissions from anaerobic ponds and demonstrating biogas use.
- Engineering consultancy companies and research organisations on demonstration of low energy wastewater treatment and algal biofuel production.
- The Met Office (United Kingdom) for supply of observations, data assimilation and numerical weather prediction Unified Model codes, collaborative research and development.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Assist major (hydro, wind) generators and marine energy developers with resource evaluation, operational monitoring, environmental impact assessments and consenting.
- Demonstrate biogas to vehicle fuel conversion with the Biogas Transport Fuel cluster.
- Commercialise covered anaerobic ponds for agricultural wastewater treatment, and demonstrate the generation of energy from ponds to local territorial authorities and industry.
- In collaboration with a biofuels development company and Christchurch City Council, develop and demonstrate wastewater treatment and algal biofuel production.

- Create and analyse scenarios of New Zealand's energy future, including the effects of climate change with government agencies.
- Develop operational forecast products in partnership with electricity generators, operators and regulators.

IMPACT MEASURES:

1. New Zealand's proportion of renewable electricity generation has increased through the successful integration of new energy resources and more efficient operation of existing resources.
2. New Zealand's first marine energy devices have been deployed and are contributing to generation output.

KEY PERFORMANCE INDICATORS:

1. High resolution forecasts of wind energy have been validated and demonstrated to wind generators by July 2012.
2. EnergyScape scenario modelling tools have been developed for use by industry and government planners by July 2012.
3. Tools to assess the available marine resources and their limitations have been developed and the environmental impacts are sufficiently well understood to support consent applications by developers by 2013.
4. Large-scale demonstration wastewater pond systems that incorporate energy recovery and algal harvest technologies have been commissioned by 2014.

2.9. CLIMATE

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase the resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, flood and climate change acceptable
- Enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants
- Increase understanding of the Antarctic and Southern Ocean climate, cryosphere, oceans and ecosystems and their longer-term impact on New Zealand

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand is well prepared for and adapts effectively to the opportunities and impacts of our current climate and that resulting from climate change.

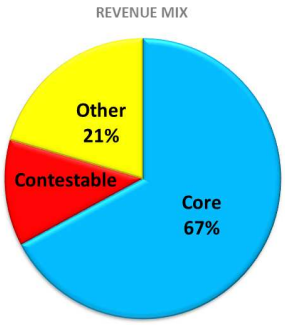
By undertaking the following science programmes:

1. Observe, analyse and document the climate of New Zealand, the SW Pacific, Southern Oceans and Antarctica – past and present.
2. Determine how the dynamics of the climate system influences atmosphere, ocean, ice and hydrosphere conditions in our region, and identify the causes of changes.
3. Develop improved predictions of climate and climate extremes on all timescales through dynamical modelling and statistical techniques.
4. Determine present and future vulnerability, impacts and adaptation options to climate variability and changes in New Zealand, the SW Pacific, Southern Oceans and Antarctica.

Key productive sectors of New Zealand's economy, such as agriculture, forestry, fisheries, energy and tourism, depend on favourable climatic conditions and are impacted by extremes and changes. Our science will aim to contribute to international climate initiatives, assist central and local government to build resilience to climate fluctuations and enable productive sectors to exploit present and future climate resources.

INVESTMENT:

NIWA plans to invest c. $18M of its core funding over the next five years to advance research in the science programmes described above and transfer climate knowledge to those who plan and undertake climate-sensitive activities and develop climate-related policies. Support for these activities also comes from the Ministry of Science & Innovation contestable fund and a variety of central government agencies and businesses. NIWA's investment in updating its high performance supercomputing facilities and the climate observing network provide a strong infrastructure base.



RELEVANCE TO STAKEHOLDERS:

- Central and local government, and the agriculture, energy generation, water supply, engineering, building design and construction, tourism, forestry and fishing sectors need observation-based information and tools on the current state of the climate and decadal-to-century trends and projections to manage and plan their activities and develop their policies.
- Other science groups, nationally and internationally, require regional climate information to determine the vulnerability, impacts and adaptation opportunities for natural and managed systems.

- Stakeholders seek information about how land and water resources are likely to be affected by climate change, and integrated strategies that help respond to the linked issues of climate change, natural hazards and sustainable development.
- Southwest Pacific Island nations with traditional links to New Zealand need assistance with building their own capacity to deal with climate extremes and change. New Zealand carries commitments to such assistance through Agreements under the UN Framework Convention on Climate Change and related instruments.
- Climate summaries and predictions at multi-week, seasonal and annual timescales help climate-senstive sectors maximise productivity and minimise risk.
- A robust set of data and publications from our region is vital input for the Intergovernmental Panel on Climate Change Fifth Assessment (2014), which will provide an authoritative basis of information for international and national policy decisions on climate change.

KEY SCIENCE COLLABORATIONS:

- National research organisations and universities on regional climate modelling, snow and Antarctic ice research.
- New Zealand MetService for the exchange of data from observation networks.
- The New Zealand Climate Change Centre for collaboration on and dissemination of climate change science and adaptation and mitigation approaches.
- Australian research organisations to share and develop expertise and joint projects on climate trends, climate dynamics and modelling, and Southern Ocean and cryosphere processes.
- International organisations and agencies on climate modelling, detection and attribution of climate change, and atmosphere and ocean measurements, monitoring, analysis and dissemination.
- Pacific development organisations to assist with climate monitoring, research and capacity building.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Develop and produce information and tools for seasonal summaries and outlooks, current and future climates, and implications for end-users and deliver these through web services or industry-linked providers and professional groups.
- Assist with production of the Intergovernmental Panel on Climate Change assessment reports through author, reviewer and Working Group Vice-Chair roles.
- Workshops, round-tables, conferences and publications for climate knowledge sharing and delivery through the New Zealand Climate Change Centre.
- Assist central and local government with future planning and policy development associated with the national effects of projected climate variability and change.
- Assist climate-sensitive industries (e.g. primary sector, energy, infrastructure) prepare for projected climate variability and change.

IMPACT MEASURES:

1. Improved weather and climate forecasts provide efficiencies and productivity gains for climate sensitive sectors of the New Zealand economy.
2. Organisations, sectors and councils manage vulnerabilities and exploit opportunities related to climate extremes and change.

KEY PERFORMANCE INDICATORS:

1. Produce robust updated New Zealand regional and national statistics on climate averages, variations, extremes and trends by July 2012.
2. Deliver Lead Author and Review Editor material for the Intergovernmental Panel on Climate Change Fifth Assessment, and produce updated climate change scenario and impacts guidance material for end-users by 2014.
3. Regional climate modelling has provided improved risk projections of New Zealand's future climate and extremes by 2015.
4. Research on climate processes has led to improved Antarctic sea-ice models, and determined causes of extreme events and changes in New Zealand's climate by 2016.

2.10. ATMOSPHERE

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants.

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand reduces emissions of greenhouse gases, ozone depleting substances and local air pollutants to mitigate long term climate change, ozone depletion and human health impacts.

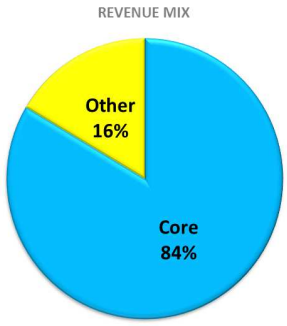
By undertaking the following science programmes:

1. Monitor atmospheric constituents and radiation relevant to climate change (global warming, ozone depletion and their interactions), to report the state of the atmosphere, and advance modelling to improve long-term predictions of global change.
2. Determine the role of oceans in governing climatically important gases and aerosol to quantify greenhouse gas exchanges and reservoirs, improve global models and inform geo-engineering options.
3. Quantify New Zealand's greenhouse gas emissions in order to improve national inventories and validate mitigation options.
4. Determine the impacts of changing radiation and air pollutants on human health and evaluate mitigation options.

New Zealand makes an important contribution to international knowledge of the changes to the composition of the global atmosphere, as it is one of the few Southern Hemisphere countries with the appropriate expertise. There is also a need to reduce national emissions, especially green-house-gases and air pollutants to meet international agreements and local regulations. Our science will aim to further New Zealand's contribution to global initiatives to monitor and predict Southern Hemisphere atmospheric composition changes, validate emission mitigation measures, and develop future emission policies and standards.

INVESTMENT:

NIWA plans to invest c. $28M of its core funding over the next five years on the science programmes described above. Others seek advice from us, particularly in relation to air quality issues. This research relies upon NIWA's major facilities at Greta Point and Lauder. Modelling and scenario generation is dependent on the NIWA High Performance Computing Facility.



RELEVANCE TO STAKEHOLDERS:

- Research is aligned with strategies for major international programmes (e.g., International Geosphere Biosphere Program, Surface Ocean Lower Atmosphere Study, International Global Atmospheric Chemistry, Stratospheric Processes and their Role in Climate, Network for the Detection of Atmospheric Composition Change (NDACC)).
- Outputs contribute to the Intergovernmental Panel on Climate Change (IPCC) and WMO/UNEP (World Meteorological Organisation/United Nations Environment Programme) assessments and assist in meeting national responsibilities within the Montreal and Kyoto protocols.
- New Zealand's adherence to the Kyoto protocol and the implementation of the Emissions Trading Scheme require science based understanding of the sources and sinks of greenhouse gases and validation of emissions at a source and national level.
- Ministry for the Environment requires a scientific basis for setting and revising National Environmental Standards (NES) for air quality. Regional Councils are charged with meeting the NES and require tools and information to assist them quantify their emissions, assess policy and planning options, and validate the resulting mitigation.

- Public health policy needs improved understand of causality in air pollution epidemiology, requiring high quality estimates of individual exposure.

KEY SCIENCE COLLABORATIONS:

- NDACC partners for equipment and measurement co-ordination, and international agencies that contribute to global atmosphere measurement initiatives and support chemistry climate and carbon cycling models.
- National and international universities in ocean chemistry, microbiology, air-sea dynamics, air quality and UV exposure and impacts.
- The Orbiting Carbon Observatory satellite team, the Total Column Carbon Observing Network, and US and Japanese agencies for ground based and satellite measurements.
- The New Zealand Agricultural Greenhouse Gas Research Centre and the Ministry of Agriculture and Forestry research groups MethaNet and NzONet, and international organisations involved with agricultural greenhouse gas measurements.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Input of quality controlled data into international databases (e.g., NDACC, Global Atmosphere Watch (WMO), World Ozone and Ultraviolet Data Centre, World Data Centre for Greenhouse Gases, Carbon Dioxide Information Analysis Centre).
- Input to Ministry for the Environment and Statistics NZ reporting of New Zealand's atmospheric composition and emissions.
- Contributions to major international assessments such as the IPCC and WMO/UNEP ozone assessments and international programme reports.
- Provide data on agricultural emissions, inventories and measurement/verification techniques to key government agencies.
- Work directly with regional councils and through the Regional Council Air Quality Working Group for direct uptake of research results, tools and services to assist in meeting NES.
- Work with health researchers and professionals, providing information on UV exposure/deficit and air quality pollution exposures.

IMPACT MEASURES:

1. New Zealand's agricultural greenhouse gas emission reductions have been validated to internationally accepted standards.
2. National Environmental Standards for air quality have been refined, and regional councils are able to assess their air quality and meet standards.

KEY PERFORMANCE INDICATORS:

1. Quality controlled atmospheric measurements have been archived annually in major international databases.
2. State of the art chemistry-climate models have been implemented on the new High Performance Computer by June 2012 and developed to predict future atmospheric composition changes by 2014.
3. Ground-based remote sensing measurements have been used to validate greenhouse gas retrievals from satellite measurements and the distribution of CO2 over the greater New Zealand region estimated to assess carbon sources and sinks by 2014.
4. Paddock-scale measurements are accepted as an accurate validation technique for agricultural greenhouse gases emissions by 2015.
5. Human exposure to atmospheric pollutants in urban areas has been estimated and the main causes identified by 2015.

2.11. TE KŪWAHA-MĀORI ENVIRONMENTAL RESEARCH

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management and use of aquatic resources.
- Grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources.
- Increase the resilience of New Zealand and South-West Pacific islands to tsunami and weather and climate hazards, including drought, floods and sea level change.
- Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity.

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

Enhance the social, environmental and economic outcomes of Maori for the benefit of all New Zealanders.

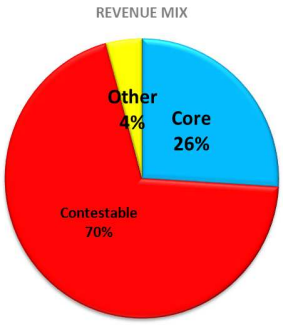
By undertaking the following science programmes:

1. Develop tools for the management and restoration of aquatic taonga species.
2. Determine the impacts of climate change on Māori, including areas of vulnerability, coping capacity and adaptation options.
3. Develop knowledge and tools that support increased investment and returns from the Māori economy.

The Māori economy is estimated at approximately $16B per annum, representing 5% of New Zealand's GDP, and has an asset base of $37B focussed on the export sectors of seafood, forestry, and farming.[2] Treaty Settlements are more formally recognising the environmental stewardship role of iwi, and restoration of aquatic environments is often a key form of redress included in the settlements. Effort within this Centre is aimed primarily at the transfer of NIWA's knowledge to Māori entities in a manner that encourages uptake and adoption for economic, social and environmental benefit.

INVESTMENT:

NIWA will invest c. $2.5M of its core funding over the next five years to help support activities in this Centre, but delivery of the science programmes described above will be reliant on contestable funding from the Ministry of Science & Innovation (currently $1.3M per annum). Funding from other sources is currently low but may be expected to increase as Māori entities look to achieve greater economic returns from their assets and seek advice to exercise their environmental stewardship role.



RELEVANCE TO STAKEHOLDERS:

- Government's Vision Mātauranga policy, which supports: (1) Taiao—helping Māori communities to achieve environmental sustainability by strengthening iwi and hapū relationships with land and sea resources and their role in kaitiakitanga; (2) Hauora/Oranga—addressing a distinctive challenge for Māori communities that contributes to health and social wellbeing; and (3) Mātauranga—bridging the interface between indigenous knowledge and R, S & T.
- Māori have significant investment in the primary sector, most of which are climate and weather sensitive industries.
- Māori fishing companies control approximately 37% of New Zealand's domestic fishing quota and are a significant investor in aquaculture. Knowledge developed in our Fisheries and Aquaculture Centres will assist these entities diversify and reach their growth potential.
- Co-governance and co-management of water between iwi/Māori and the Crown poses challenges in bringing together differing viewpoints on the use of this natural asset. Science can play an important role, alongside mātauranga Māori, in defining the status of waters and providing rehabilitation options that are supported by iwi and the wider community.

[2] http://www.tpk.govt.nz/_documents/taskforce/met-rep-assetbaseincexpend-2011.pdf

KEY SCIENCE COLLABORATIONS:

- Māori researchers in other CRIs, Universities, consultancies and iwi authorities. Skills are thinly-spread and forming 'best teams' is important to ensure quality research that enhances uptake and adoption.
- Scientists within NIWA whose primary research may be focussed in other National Centres. These scientists provide the underlying scientific knowledge used by this Centre to develop appropriately tailored tools for Māori communities and businesses.
- International collaborations where these provide best practice examples of economic and social benefits to indigenous peoples from the transfer and uptake of science.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- In partnership with Māori Fishing Companies, iwi and hapū, assist in the development of an integrated approach to the management of Māori commercial and non commercial fisheries interests.
- Provide tailored workshops for Māori land-based businesses to enhance uptake and application of climate information in their operations so that profits increase and risks are lowered.
- Assist Māori to prepare rohe-specific research strategies that will provide the information needed to protect and enhance their values and aspirations for aquatic ecosystems and associated taonga species.
- Engage in community-based aquatic restoration projects, transferring scientific knowledge and tools to other participants and monitoring the projects' success.
- Work with Māori research partners, local authorities, and relevant government agencies on a centralised web portal for the storage of data and information gathered during Māori environmental and cultural indicator monitoring activities.

IMPACT MEASURES:

1. Māori business show increased profitability and return on assets as a result of seizing new opportunities provided by our science.
2. Aquatic resource management is enhanced through the full participation of Māori, and degraded waters (and associated taonga) show recovery.

KEY PERFORMANCE INDICATORS:

1. Research on climate impacts and adaptation strategies are transferred to Māori business at the Māori Climate Forum in 2012 and used in the IPCC's 5th Assessment Report.
2. Successful completion of a feasibility study for a new business opportunity in partnership with Māori by 2013.
3. Complete development of toolkits for monitoring river and estuarine values and train kaitiaki groups in their use by 2014.
4. Complete surveys of five customary fishery areas (e.g., Mātaitai) and use data to develop customary harvest plans in collaboration with iwi, by 2015.

2.12. ENVIRONMENTAL INFORMATION

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management of aquatic resources
- Grow renewable energy production through developing a greater understanding of renewable aquatic and atmospheric energy resources
- Enable New Zealand to adapt to the impacts and exploit the opportunities of climate variability and change and mitigate changes in atmospheric composition from greenhouse gases and air pollutants
- Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity
-

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand possesses an integrated environmental data and information collection, storage, processing, and dissemination system so that environmental state and trend reporting, wise resource use and responses to environmental hazards are improved.

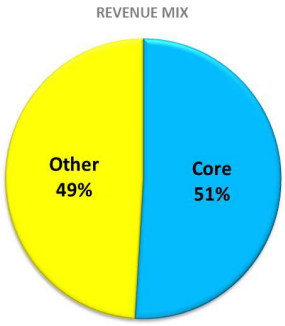
By undertaking the following science programmes:

1. Environmental monitoring - Conduct national environmental monitoring programmes for climate and freshwater with consistent, state-of-the-art technologies and protocols to underpin robust environmental assessment and reporting.
2. Information management - Implement and maintain robust information infrastructures to provide future-proof archives for New Zealand's climate, freshwater, marine and biological information.
3. Information delivery - Develop state-of-the-art, user-centric delivery services that enable information access and re-use for improved resource management and business decisions.

New Zealand's economy is founded on weather and climate sensitive primary industries, our freshwater is one of our most valuable natural assets, and our marine and freshwater biological communities show a high level of endemism. Science in this Centre seeks to maintain the integrity of NIWA's national environmental monitoring networks and ensure that environmental information products are made available for resource managers and businesses.

INVESTMENT:

NIWA plans to invest c. $30M of its core science funding over the next five years to assist delivery of the science programmes above. NIWA's national networks, collections and databases are well-established but improvements are required to meet the expectations of stakeholders. It is anticipated that industry will increasingly invest in our capabilities as we align our services with their needs. NIWA capital investment over the next five years is planned to improve data capture and information delivery.



RELEVANCE TO STAKEHOLDERS:

- Various industries (e.g., energy, agriculture, horticulture, viticulture, and mining) increasingly use and require up-to-date, easily accessible, quality-assured environmental information to assist in their day-to-day decision-making and their longer term planning. There is a need to improve information consistency and delivery to serve those needs.
- New Zealand's State of Environment (SoE) reporting and production of national environmental statistics on a regular basis require environmental data that are consistently collected and well archived.
- An expectation in the digital age is that information is accessible on an 'anywhere, anytime' basis and environmental information is no different. Only well-managed data can be made accessible in useful ways.
- Scientists and environmental managers work increasingly cross-disciplinary and want to access and combine data and information from outside of their specific field of interest. Integrated information management is required to connect and access cross-disciplinary information.

KEY SCIENCE COLLABORATIONS:

- Ministry for the Environment and regional councils as partners for improving consistency in environmental monitoring and information management practice across New Zealand.
- International organizations for developing and adopting international environmental monitoring protocols, integrating New Zealand with global environmental data networks and adopting international interoperability standards for environmental information.
- Te Papa and Landcare Research to develop and improve New Zealand's collections and digital archives for biological specimens.
- Partnering with other CRIs to make our science and delivery services more relevant to the primary production sector.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Develop new flexible and user-centric service delivery systems that provide businesses with real-time data on the environment to enable them to make key operational decisions.
- Partner with Government agencies to improve national-scale environmental monitoring.
- Maintaining our Nationally Significant Databases for climate, water resources, water quality, freshwater fish and marine invertebrates and making them more easily accessible.
- Develop modern high-quality sensor, logger, telemetry hardware and software and web-enabled logger control systems for uptake by end users.
- Develop and publish NIWA's monitoring, sampling, and quality assurance protocols, in cooperation with relevant stakeholders (regional councils and others).
- Develop and conduct training programmes in environmental monitoring in cooperation with relevant stakeholders (regional councils and others).
- Link NIWA data catalogues and databases with archives and services developed by other organizations into federated systems, thereby allowing rapid and integrated discovery of New Zealand's environmental information.
- Develop and adopt modern information transfer standards in cooperation with other agencies (e.g., Geospatial Office and Land Information New Zealand).

IMPACT MEASURES:

1. Reporting of the state and trends in the nation's atmosphere, climate, freshwater, and marine systems and biota is more consistent and supported by national standards and qualification frameworks.
2. New Zealand fulfils its international environmental reporting obligations and is seen as a leading nation in environmental monitoring.
3. Climate and weather sensitive industries are more profitable and resilient through greater use of environmental data to make better decisions.

KEY PERFORMANCE INDICATORS:

1. The NIWA data catalogue is developed and populated with core NIWA datasets and discoverable by stakeholders by July 2012.
2. The NIWA station information system provides integrated access to all of NIWA's networks by 2013.
3. NIWA standard operating procedures and quality assurance protocols for its major atmospheric, climate, freshwater, oceanic, and biologic monitoring and sampling operations are up-to-date, documented and accessible to relevant stakeholders by 2015.
4. 'Weakly managed information' (science data not captured by national databases) is documented in the NIWA data catalogue. By 2016, 80% of all information generated in science projects is discoverable through the data catalogue.

2.13. PACIFIC RIM

Science within this Centre addresses the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management and use of aquatic resources
- Grow renewable energy production through developing a greater understanding or renewable aquatic and atmospheric energy resources
- Increase the resilience of New Zealand's and South-West Pacific Islands to tsunami and weather and climate hazards, including drought, flood and sea-level change.

DELIVERY OF BENEFIT:

This Centre will contribute to the following national benefit:

New Zealand has contributed to the capacity of the Asia-Pacific region to sustainably manage natural resources and prepare for and respond to natural disasters.

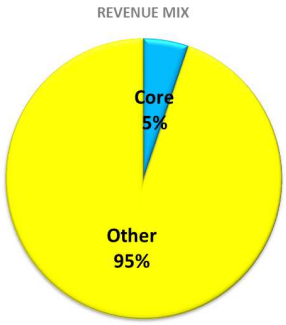
By undertaking the following science programmes:

1. Provide scientific advice and build local capacity in the Asia-Pacific region to support environmental, infrastructure and economic decision-making and development.

The Pacific and Asian region faces ever-increasing environmental challenges, especially in relation to food and water security. There is an urgent need to advance sustainable management of marine and freshwater resources, reduce community and economic vulnerability to natural hazards, and adapt to the impacts that climate change will increasingly cause.

INVESTMENT:

NIWA will invest c. $1M of its core funding over the next five years to advance our knowledge transfer and relationship-building in the Asia-Pacific region. The majority of revenue required to implement our strategy will be derived from international aid and development agencies.



RELEVANCE TO STAKEHOLDERS:

- Development assistance in the Asia-Pacific region is continuing to increase, with an increased focus on development effectiveness and aid efficiency but there continues to be variable and limited in-country technical and absorptive capacity.
- The European Union, Australia, Asian Development Bank (ADB), World Bank, and UN agencies are significant funders. There is an increasing emphasis on activities with tangible outcomes, and an ongoing focus on areas that align with New Zealand's development aid objectives.

- New Zealand's International development assistance (through the Ministry of Foreign Affairs International development Group – MFAT-IDG) is focused on the Pacific countries, specifically Cook Islands, Niue, Tokelau, Samoa, Tonga, Papua New Guinea, Solomon Islands, Vanuatu, Tuvalu, Kiribati and Fiji, with Indonesia, Timor-Leste, Vietnam, Philippines, Cambodia and Lao PDR of key interest in SE Asia.
- Growing New Zealand's international effectiveness through science diplomacy and the development of bilateral scientific collaboration with Europe and the US.
- Regional agencies in the Pacific are increasingly realising the value of technical advice from NIWA to support the development of proposals for global funding initiatives, and technical support in implementation.
- Opportunities to realise deep-sea mineral resources in the Pacific region, prompting the issue of prospecting licences in Papua New Guinea, Fiji and Tonga.

KEY SCIENCE COLLABORATIONS:

- Secretariat of the Pacific Community and Secretariat of the Pacific Regional Environment Programme to advance environmental management initiatives.
- New Caledonian and French research institutes to complement NIWA expertise in climate, marine geology and hazards, wastewater treatment and marine biodiversity.
- Bureau of Meteorology (Australia), CSIRO (Australia), Meteo France and NOAA (US) to advance climate and climate change initiatives in the Pacific.
- University of the South Pacific to build new science capacity in the Pacific.
- Key Pacific government departments and agencies responsible for environmental management
- New Zealand government departments involved in State Sector Development Projects in the Pacific (e.g., Ministry of Agriculture & Forestry Biosecurity NZ, Department of Conservation).
- Other Crown Research Institutes, environmental and engineering consultancy organisations and key non-governmental organisations active in the Pacific.

KNOWLEDGE AND TECHNOLOGY TRANSFER/COMMERCIALISATION:

- Continue to provide environmental information and tools into the Pacific-Asia region through working in collaboration with both regional and government staff.
- Contribute to key science and applied science forums, meetings and conferences in the Asia-Pacific region.
- Train, mentor and host short-term secondments of key regional and government staff from Pacific-Asian countries to build local capacity.
- Provide technical support and advice to the MFAT International Development Group and other regional and donor staff, particularly United Nations Development Programme and World Bank Pacific Offices.

IMPACT MEASURES:

1. New Zealand's science-based activities and initiatives in the Pacific Rim have helped to lift economic performance and reduced the impacts of climate and weather-driven hazards
2. New Zealand's foreign affairs relationships in the Pacific Rim have been enhanced as a result of increased collaborative science in the region.

KEY PERFORMANCE INDICATORS:

1. NIWA is represented and attends at least eight key regional meetings in the Pacific- Asia region to develop networks, identify assistance opportunities and facilitate implementation of work programmes, and advance New Zealand's international reputation, by July 2012.
2. Involvement in National Adaptation Programme of Action implementation projects in at least two further countries by July 2012.
3. Mutual awareness and new scientific collaboration is established with two Pacific countries that focus on wastewater treatment and biodiversity, biosecurity and aquaculture by end of 2013.
4. Develop at least two Pacific-based science initiatives with US/Australian/French science organisations, or the University of the South Pacific, by 2013.

2.14. NIWA VESSELS

Services provided by NIWA's vessels address the following Outcome(s) in NIWA's Statement of Core Purpose:

- Increase economic growth through the sustainable management and use of aquatic resources.
- Enhance the stewardship of New Zealand's freshwater and marine ecosystems and biodiversity.
- Increase understanding of the Antarctic and Southern Ocean climate, cryosphere, ocean and ecosystems and their longer-term impact on New Zealand.

DELIVERY OF BENEFIT:

NIWA's vessels will contribute to the following national benefit:

- New Zealand advances the development and management of its oceanic and seabed resources through efficient operation of dedicated research vessels.

By advancing the following initiatives:

1. Provision of dedicated research vessels to support New Zealand's ocean-based research and surveying, from the coastal margin to the deep-sea.
2. Efficient and cost effective operation of the vessels through improved planning and a more unified national approach to ocean research and surveying.
3. Continued upgrading and improvement of the vessels to ensure that they meet both the current and future ocean research and survey needs of New Zealand.

INVESTMENT:

NIWA owns and operates three purpose-built research vessels, *Tangaroa*, *Kaharoa* and *Ikatere*, which provide the principal platforms for ocean-based research and surveying in New Zealand by NIWA and others. The vessels are managed and supported by 10 FTE's (includes workshop personnel), and crewed by 26 permanent FTE's and 5 fixed term FTE's. NIWA invested $24M into the installation of dynamic positioning and system upgrades and refurbishment of the *Tangaroa* between 2009 and 2011. These improvements have broadened the vessel's capability and are expected to extend its useful life by another 20 years. On-going investment over the next five years for the vessels will cover replacement of aging vessel infrastructure.

RELEVANCE TO STAKEHOLDERS:

- Access to cost effective vessel platforms will encourage and facilitate industry exploration and investment into exploitation of ocean based oil, gas and mineral resources.
- The growing conflict between the multiple users of coastal and oceanic regions and the need for the collection of fundamental survey information to inform current management and future policy development.
- The need to collect information critical to New Zealand's international obligations (e.g., United Nations Law of the Sea) and hazard mitigation (e.g., hydrographic charting).
- Vessels are required for the collection of the data and knowledge required to manage or mitigate the important influence the ocean has on New Zealand's industries (e.g., fisheries and aquaculture) and infrastructure (e.g., climate, earthquakes, tsunami, cable networks).

KEY COLLABORATIONS:

- Key Crown customers, especially the Ministry of Fisheries, Land Information New Zealand and Crown Minerals, to ensure that vessel based activities are cost effective and efficient.
- Marine based industries to provide cost-effective vessel platforms that will promote and grow use and economic return from marine resources.
- Land Information New Zealand and the Royal New Zealand Navy to ensure that New Zealand maintains a cost effective and efficient hydrographic surveying capability.

IMPACT MEASURES:

1. Exploration activity within the New Zealand EEZ has increased through the provision of *Tangaroa*.
2. New Zealand is able to meet its international obligations associated with the governance of its maritime region and resources through the research and surveying provided by NIWA's vessels.

KEY PERFORMANCE INDICATORS:

1. Annual scientific voyages conducted on the vessels are on-time and within specifications.
2. Key government agencies are working in partnership with NIWA to ensure efficient use and maximum utilisation of *Tangaroa*.
3. Marine based industries are using NIWA's vessels to explore ocean resources within the New Zealand Exclusive Economic Zone.
4. High annual utilisation of the *Tangaroa*, *Kaharoa* and *Ikatere*.

3 SUPPORT SERVICES

3.1. KEY ORGANISATIONAL DRIVERS AND EXTERNAL TRENDS

To ensure NIWA is able to deliver the national benefits expected from its expertise and knowledge NIWA's organisational environment must:

- Be robust, efficient and effective, and support customer and stakeholder expectations for transparency and accountability.
- Support the best staff, and the best teams – often comprising collaborations with other providers.
- Provide optimal access and dissemination of our data, information and knowledge.

ROBUST, EFFICIENT AND EFFECTIVE SYSTEMS AND PROCESSES

New Zealand is a small country operating in a global economy under tight fiscal constraints, and to be successful as a nation we need to work together. There are a number of "all-of-Government" initiatives underway which NIWA has taken an active role in (e.g., collaborative research infrastructure initiatives, government procurement processes). We welcome these efforts to align the interests of multiple agencies for national benefit, and will continue to direct our efforts in this way wherever possible.

NIWA has made considerable investment over the last few years in developing more robust, efficient and effective business systems from which to deliver its science. Moving forward, our challenge is to harness this investment to improve productivity and efficiency throughout NIWA. Key high level goals are to:

- Minimise administrative demand on science staff.
- Maximise the use of electronic media for business support processes and systems, so that a 'write once, use many' approach becomes a 'foundation-stone' of our support services.
- Maximise speed and effectiveness of communication internally and externally on all aspects of our science projects and support systems.

DEVELOPING AND SUPPORTING THE BEST STAFF AND TEAMS

Recent changes in the CRI sector, with increased emphasis on technology transfer, innovation and collaboration, may mean we need to recruit people with different strengths and skills than previously. There may be more need for expertise in aspects such as science communication, building relationships with industry, and providing solutions to end users.

Demand for environmental science knowledge and expertise continues to grow despite the recession and there is a global skills shortage in this area. This difference in supply and demand is unlikely to change over the next five years. Furthermore, there are insufficient numbers of graduates qualified to the appropriate level in the required areas entering the workforce, and there is a

relatively long lead time to develop the level of experience and specialised knowledge that NIWA and New Zealand needs.

Marked differentials exist between New Zealand and international remuneration levels for scientists and it is an on-going challenge for NIWA to attract and retain high performers. Greater collaboration with the tertiary education sector will be essential to improve the supply of appropriately trained talent. NIWA, like other science organisations, will need to do more to train and up-skill its people internally, and collaborate with other organisations to share skills.

The diverse range of settings, locations and conditions that NIWA staff work in poses a challenge from safety and health perspective. Continual focus on managing these risks to ensure that staff and the public are protected is essential.

NIWA will continue to be influenced by changing population demographics and workforce trends. Greater workplace flexibility will be required in response to trends such as dual career families, increased life expectancy and better health status meaning people need and want to work for longer, a more multi-cultural workforce, and a desire for a balanced lifestyle and quality of life.

OPTIMISING ACCESS AND DISSEMINATION OF OUR DATA, INFORMATION AND KNOWLEDGE

For NIWA's science to have impact, our communications strategy and activities need to be highly effective, proactive and responsive to changing technology and societal expectations. We need to ensure that the results of our work are communicated quickly and accurately, through the right channels, to the right audiences, and in ways that enhance their understanding and use.

Information technology is integral to effective communications, collaboration and decision-making, efficient operations, and effective service delivery at NIWA. Rapid technological change offers both opportunities and challenges. Within NIWA the explosion of data from its science activities fuels demand for increased computing power and data storage.

Multi-disciplinary science collaborations with other organisations (CRIs, universities, other New Zealand and international research institutes) are growing, and are enhanced by effective technology. Staff expect and demand more sophisticated IT tools in the workplace, and flexible workplace practices require new approaches.

The huge growth in mobile information services in recent years has people expecting anywhere/anytime access to "good enough" information for decision-making. There is a growing thirst for geospatial and geotemporal information, and a growing demand for interactive website features (e.g., discussion forums, page comments, ratings).

There is also a growing global demand for greater access to publicly funded data and research results. This is reflected in NIWA's Statement of Core Purpose, which states that NIWA will maintain its databases, collections and infrastructure and manage the scientific and research data it generates in a sustainable way, providing appropriate access and maximising the reusability of data sets. NIWA's key external stakeholders have always had high expectations in terms of data access, which we have responded to, and we can expect these expectations to continue to grow.

3.2. SCIENCE DELIVERY

Purchasers of science and innovation services are expecting a new and higher impact approach from science providers. To respond to this demand NIWA will continue to invest in and develop three key areas: people, processes and systems, and places.

PEOPLE – we need to enhance:

- Staff capability and capacity and ensure it is aligned to obligations outlined in our Statement of Core Purpose and to market demand.
- Staff productivity and output quality, including consistently achieving billable hour targets and margins.
- Quality of 'at work experience'.
- Internal communication and engagement.
- Collaborations with others to ensure 'best team' approach.
- Customer interaction and engagement based on meeting or exceeding their expectations of value.

PROCESSES & SYSTEMS – we need to enhance:

- Access to, and dissemination of, our new science findings.
- Abilities to collaborate internally and externally.
- The management of work activities from opportunity/idea discovery to product or service delivery.
- Utilisation and adaptation of appropriate technologies and processes.
- Cost-effectiveness of science/support service delivery.
- Human and environmental risk identification and mitigation.

PLACES – we need to invest in:

- Specialised facilities and equipment (including labs, instruments, monitoring networks and high performance computing capability, vessels and vehicles,)
- Fit for purpose buildings and infrastructure

3.3. INFORMATION TECHNOLOGY (IT)

To deliver leading environmental science, NIWA needs best-fit IT that enables effective collaboration and decision-making; efficient operations; and excellent service delivery. Over the next five years we will continue to invest in the evolution of our IT systems and services to deliver on these goals with the following outcomes in mind:

- Access and collaboration is frictionless and seamless across NIWA and around the globe.
- Systems and standards encourage innovation, efficiency, and delivery.
- Data, information, and knowledge are readily captured, stored, interconnected, shared, re-used, and traced back to their origins.

- Customers can acquire and interact with data and knowledge from NIWA via a small number of well-integrated e-delivery channels.
- Computing, storage, and network capacity is well-matched to reasonable demand.

Key actions to bring us closer to achieving these goals include:

- Promote a culture of "IT is integral to science" and manage accordingly, investing in people who acknowledge and support that mindset;
- Ensure that enterprise-architecture priorities are set by a demand-side authority;
- Invest in technologies that enhance collaboration, communication, and knowledge-sharing;
- Invest in smart data storage and information management technologies;
- Invest in geotemporal technologies and expertise;
- Invest in tools that allow rapid deployment of new systems and services.

Key priorities over the 2011/12 financial year will be:

- Complete our move to mainstream core systems and invest in unifying our collaboration and communication systems;
- Establish a demand-side authority for steering enterprise architecture (while continuing to improve the IT supply-side management) and act in response to the priorities set by that authority, most likely in the areas of data and information management and access.
- Refit main seminar rooms and meeting rooms to enable easy broadcasting and recording of seminars as well as simplified high-quality videoconferencing;

3.4. HUMAN RESOURCES

People are our most important asset. To be successful in the long term, NIWA will need to be regarded internationally as an employer of choice in environmental science, providing a work environment with culture and values that attracts, develops and retains high calibre people, and enables them to excel. Over the next five years we will work towards achieving the following:

- **International reputation as an employer of choice** – NIWA will be seen as an organisation undertaking high quality applied science, with high calibre staff and modern equipment and facilities. Our recruitment and selection will reflect best practice, with a strong, positive employment brand, high standards of candidate care, and hiring managers who are skilled and competent.
- **Motivated, productive, adaptable and high performing staff** - We will foster a culture that responds positively to change and is quick to see and act on opportunities. Staff will be encouraged to develop in relevant areas and achieve to their potential. Strategic talent reviews and active talent management will be in place to ensure successors for key positions.

- **Strong, lean, sustainable organisation** – with a mutually supportive partnership between the science and support areas of the organisation. We will have the right skills and capacity to meet the market demand for our services, and will invest in capability required to take up new opportunities.
- **Proactive, effective leadership** - we need leaders at all levels who engage positively with others, communicate effectively, contribute actively and constructively to decision-making, champion organisation changes and new initiatives, and excel at bringing out the best from those they lead.
- **Excellence in health & safety** - we aspire to having zero injuries, which will only occur if we continue to promote all elements of our health and safety strategy, with health and safety integral to planning and decision-making at all levels.

Key priorities over the 2011/12 financial year will be:

- Implement a structured approach to analysing current workforce capability, forecasting future demand, and implementing strategies to ensure a good match between what we need and what we have.
- Identify leadership competencies for NIWA, and expand the repertoire of workshops in the NIWA Leadership & Management Development programme to address these leadership competencies and priority needs.
- Introduce a framework and tools for conducting strategic talent reviews, to help ensure a continued focus on targeted development for key successors, and an additional emphasis on identifying other high potential staff and ensuring their career aspirations and development needs are identified and addressed.

3.5. COMMUNICATIONS

In order to position NIWA as New Zealand's leading authority in the areas outlined in our Statement of Core Purpose our communication of that science must be clear, be tailored to the requirements of our audiences, and make full use of all appropriate channels.

To achieve this, over the next five years we will focus on:

- **Communicating the value of our science** – in terms of both economic and environmental prosperity.
- **Providing the answers and transferring the technology** – meeting the increasing demand for science to provide the answers to economic opportunities and environmental issues within our areas of expertise, in the form and substance our variety of end-users require, and in the time frame that meets their requirements.
- **Using all appropriate information channels** – ensuring tailored information and dialogue; an informative and dynamic website; focusing on electronic information transfer; and engaging social media
- **Better integrating communications into decision-making and planning** – being proactive and planned, demonstrating the value of good communications to staff and customers.

Key priorities over the 2011/12 financial year will be:

- Providing an enhanced, user-friendly website with a new Content Management System embedded, substantial and ongoing content enhancement, and continual audit.
- Maximising knowledge transfer through the media by building on NIWA's proactive and responsive interaction with mainstream media.
- Developing a better understanding of how well our communication channels work by conducting an audience survey and a publications audit, and feed the results directly into planning and practice.

3.6. LEGAL, ADMINISTRATION AND FINANCE

NIWA's back-office administrative functions will strive to achieve best practice in the delivery of legal, administrative and financial services. Some of the key drivers of improvement in back-office services are:

- **Increasing emphasis on collaboration and standardisation –** there is an increasing expectation for more internal and external seamless collaboration. To achieve this, the back-office systems and processes will require greater standardisation.
- **The continuing desire for information 'now' to support dynamic decision-making -** there is a growing expectation, internally and externally, for all financial and project information to be up-to-the-minute, accurate and available to many people irrespective of their location.
- **Operational and compliance transparency –** pressure for more transparency, particularly in the public sector, and the need to demonstrate compliance and respond to the media and public enquiries continues to intensify.

Key priorities over the 2011/12 financial year will be:

- Interfacing our Oracle database with other data systems within NIWA.
- The introduction of additional Oracle finance and project management modules such as content and work-flow management, legal, and procurement to provide a complete 'cradle to grave' administration package.
- Manage NIWA's transition to the 'whole of government' procurement initiatives.
- The ongoing delivery of user-friendly, accurate and timely financial and legal information to the NIWA Management and Board, the Ministry of Science & Innovation and Crown Ownership Monitoring Unit.

4 PERFORMANCE MEASURES

NIWA will measure its performance against the outcomes and operating principles in the Statement of Core Purpose.

KEY PERFORMANCE MEASURES WILL INCLUDE:

1. Percentage of Key Performance Indicators contained within each Science Centre Plan that are achieved to expected quality and deadline. Reported annually.
2. Narrative on progress towards achieving Impact Measures contained within Science Centre Plans. Reported annually.
3. Achievement of the following metrics in the financial budget.

MEASURE	DESCRIPTION	CALCULATION	MEASUREMENT TIMEFRAME
Revenue	Revenue from the operations of the business. Interest Revenue is excluded	Revenue	Quarterly
Current ratio	The ratio of current assets to current liabilities.	Current Assets/Current Liabilities	Annual
Quick ratio	Adjusted ratio of current assets to current liabilities, adjusted for assets that cannot be liquidated quickly and liabilities that do not require cash to settle.	Current assets less inventory less prepayments / Current liabilities less revenue received in advance.	Quarterly
Adjusted return on equity	Return on equity after removing the impact of fair value movements.	NPAT excluding fair value movements (net of tax) / Average of share capital plus retained earnings.	Quarterly
Return on assets	The efficiency and profitability of a company's assets	EBIT adjusted for IFRS fair value movements /Average total assets	Annual
Operating profit margin	The profitability of the company per dollar of revenue	EBITDAF/Revenue	Annual
Gearing	The extent to which a company is funded by debt.	Financial debt/Financial debt and Equity	Annual
Interest cover	The number of times the company can cover interest expense with profit.	EBITDAF / Interest paid.	Quarterly
Profit volatility	The standard deviation of the past 5 years' profit, scaled by average profit.	Standard deviation of EBITDAF for past 5 years / Average EBITDAF for the past 5 years.	Annual
Forecasting risk	The average difference between forecast return on equity and actual return on equity for the past 5 years.	5-year average of return on equity less forecast return on equity.	Annual
Capital renewal	Measure of the level of capital investment being made by the company.	Capital expenditure / Depreciation expense plus amortisation expense.	Quarterly

In addition, NIWA will report on non-financial and financial monitoring indicators required by the Ministry of Science & Innovation as listed below.

NON-FINANCIAL AND FINANCIAL INDICATORS REQUIRED BY THE MINISTRY OF SCIENCE & INNOVATION

End User Collaboration - CRIs are expected to develop strong, long-term partnerships with industry, government and Māori, and to work with them to set research priorities that are well linked to the needs and potential of their end-users (generic operating principle in SCP).

- Percentage and number of relevant funding partners and other end-users that have a high level of confidence in the CRI's ability to set research priorities, and the effectiveness of the collaboration or partnership (survey data). Annually
- Total dollar value of revenue (in cash and in-kind), and dollar value subcontracted out to other organisations from each 'source category' per annum from rolling five years (administrative data). Quarterly

Research Collaboration - CRIs are expected to develop collaborative relationships with other CRIs, universities and other research institutions within New Zealand and internationally to form the best teams to deliver the CRI's core purpose (generic operating principle in SCP).

- Percentage of relevant national and international research providers that have a high level of confidence in the CRI's ability to form the best teams to deliver on the CRI's outcomes (survey data). Annually
- Number and percentage of joint scientific peer-reviewed publications and IP outputs with other New Zealand or international research institutions per annum (administrative data). Quarterly

Technology and Knowledge Transfer (Science Relevance) - CRIs are expected to transfer technology and knowledge from domestic and international sources to New Zealand industry, government and Māori (generic operating principle in SCP).

- Total number and percentage of licensing deals of CRI-derived IP (including technologies, products and services) with New Zealand and international partners per annum (administrative data). Quarterly
- Percentage of relevant end-users who have adopted knowledge and/or technology from CRIs (survey data). Annually
- Percentage change in the number of requests and enquiries for the CRI's publicly available collections (administrative data). Quarterly

Science Quality - CRIs are expected to pursue excellence in all their activities (CRI Act).

- Total number of international awards, invitations to participate on international committees, and editorial boards for the CRI's published papers, per annum. Annually
- Average number of citations per CRI published paper. Quarterly
- Proportion of published papers in the top 25 international journals relevant to the scope of the CRI (as outlined in the SCP) per annum. Annually

Core Financial Indicators - CRIs are expected to focus on financial viability

- Projected cashflow – the measure of forward looking. Quarterly
- Operating margin – the profitability of the company per dollar of revenue. Quarterly
- Profit per FTE – the ability of the company to generate a return from its staff. Quarterly
- Revenue growth – the measure of whether the company is growing revenue. Quarterly

Note: MSI will administer and fund the rolling survey that underpins a number of the above indicators. The survey will be developed in partnership with the Crown Research Institutes and interested government agencies.

5 FINANCIALS

FINANCIAL COMMENTARY AND UNDERLYING ASSUMPTIONS FOR BUDGET:

The present recessionary economic climate is challenging and we are expecting this to continue through 2011/12 and beyond. We have approached the 5 year financial plan with conservatism but with what we believe are realistic targets. In 2011/12 we have budgeted on revenues of $123.5M, earnings before interest and taxation of $4.6 million, and an adjusted return on equity of 4.5% rising to 12.3% by 2015/16. Achieving this return will require continued stringent management of our costs.

The extended time for the refurbishment of the Tangaroa during 2010/11 proved financially challenging. As we enter 2011/12, with a fully operational vessel with enhanced capabilities, we are confident that the vessel and associated science revenues will contribute to the profitability of NIWA Group. Forward bookings for use of Tangaroa during 2011/12 are strong.

NIWA will continue to have a strong Balance Sheet. The science we are involved in is capital intensive and requires an ongoing investment in scientific equipment if we are to secure revenue and be financially successful. The last three years have seen a period of intensive capital renewal that has placed us in a good position with respect to science equipment. Moving forward into the next 5 years we have budgeted for our Capital expenditure to reduce and be c. 10% of our revenue.

REVENUE

In 2011/12 NIWA Group is budgeted to show an increase in revenue from the 2010/11 forecast, based upon the Tangaroa being available to generate a full year's revenue. In the recessionary environment other areas of revenue are budgeted to remain relatively static. In out years we are forecasting some revenue growth based upon greater uptake of our science by the business sector.

OPERATING EXPENDITURE

Operating expenses (including depreciation) are budgeted to increase from $118.3 million in 2010/11 to $118.9 million in 2011/12. Cost management and control will be crucial to NIWA achieving an overall annual cost increase of only $600,000. NIWA will commence 2011/12 with less staff than it began 2010/11 with and for the next 5 years full time employee numbers in NIWA are budgeted to remain at levels similar to those existing at 30 June 2011.

BALANCE SHEET MANAGEMENT

In the next 5 years NIWA is budgeting for capital expenditure in the vicinity of 8-11% of revenue (down from 19% over the last 3 years). This is reflected in the Capital renewal ratio which measures the capital expenditure to depreciation ratio. The ratio is expected to reduce to 59.6% in 2011/12 from 143% in 2010/11. The present value of this ratio is a reflection of the last 3 years comprehensive expenditure, two of the larger items being the Tangaroa and the High Performance Computer. The retrofit to the Tangaroa has extended the life of the ship by 20 years with new areas

of revenue generation expected to mean the payback will have an immediately positive financial impact. The ratio is targeted to track to 100% in the longer term.

NIWA is forecasting to end 2010/11 with financial bank debt of $14.6 million and this will improve to $3.8 million by the end of 2011/12. In 2012/13 NIWA has budgeted to distribute to the Shareholder a dividend of $4 million, this is the first in a series of budgeted annual dividend payments. At the end of the 5 year time frame NIWA will be generating small ($606,000) surplus cash amounts. The forecasted dividends are payable on the assumption that NIWA will be in a position of having the optimum level and mix of assets to meet its business goals.

CASH FLOW

NIWA continues to have strong operating cash flows. Recent debt has been required for the extensive capital expenditure programme. NIWA will continue to generate strong operating cash balances. Based on present projections NIWA will return to positive cash balances by 2012/13. This is prior to the payment of a $4 million dividend which will mean the 2012/13 ends with $343,000 of debt.

DIVIDEND

NIWA will be in the financial position to have available for distribution to the Shareholder a $4 million dividend by 2012/13. A dividend payment is provided for in each year thereafter. In 2013/14 the budgeted dividend payment is $8 million and $9 million in both 2014/15 and 2015/16.

ADJUSTED RETURN ON EQUITY

As stated above NIWA's budgeted adjusted return on equity in 2011/12 is 4.5%. With the return of the Tangaroa, higher utilisation of all NIWA vessels, an increased focus on working with sector partners, and dividend payments NIWA's adjusted return on equity is budgeted to return to 12.3% by 2015/16. It is the generation of strong positive operating cashflows that enables NIWA to reduce equity by paying a dividend in future years.

RISKS

More than 85% of NIWA's revenue is presently sourced from central and local Government related agencies and we have budgeted for very small (or in some cases no) increase in revenue from these sources. Our budget assumes NIWA will be successful in achieving revenue growth through working with industry sector partners and helping achieve economic growth for New Zealand. The underlying assumption is that many of these partners will be in the private sector and have the appetite for investing in science to drive their businesses forward. This anticipates NIWA's revenue reliance on the government sector to drop to less than 75% by 2015/16.

NIWA Group

RATIOS AND STATISTICS

STATEMENT OF CORPORATE INTENT	Forecast 10/11	SCI 11/12	SCI 12/13	SCI 13/14	SCI 14/15	SCI 15/16
Revenue ($000s)	118,881	123,507	128,111	132,346	137,603	142,950
Operating results						
Operating expenses & depreciation ($000s)	118,288	118,869	122,884	125,454	129,021	132,318
EBITDAF	16,057	21,527	23,243	24,546	25,815	27,755
EBIT & dividend received ($000s)	593	4,638	5,228	6,892	8,582	10,633
Profit before income tax ($000s)	220	4,199	5,093	6,840	8,636	10,703
Profit after Tax ($000s)	154	3,023	3,667	4,925	6,218	7,706
Average total assets ($000s)	131,091	132,193	127,786	124,770	122,837	122,221
Average equity ($000s) (Shareholders' funds)	89,128	90,652	92,003	90,299	87,371	85,333
Adjusted Average total assets ($000s)*	103,854	104,956	100,549	97,533	95,600	94,984
Adjusted Average equity ($000s)*	66,266	67,790	69,141	67,437	64,509	62,471
Capital expenditure (incl Capital committed)	22,106	10,071	12,842	13,266	15,167	15,756
Capital expenditure % to Revenue	18.6%	8.2%	10.0%	10.0%	11.0%	11.0%
Liquidity						
Current Ratio	72.3%	94.6%	108.4%	108.7%	103.9%	102.0%
Quick Ratio (aka. Acid test)	0.88	1.31	1.59	1.56	1.47	1.41
Profitability						
Adjusted Return on Equity*	0.2%	4.5%	5.3%	7.3%	9.6%	12.3%
Return on Equity	0.2%	3.3%	4.0%	5.5%	7.1%	9.0%
Return on Assets	0.5%	3.5%	4.1%	5.5%	7.0%	8.7%
EBIT Margin (aka. Operating profit margin)	0.5%	3.8%	4.1%	5.2%	6.2%	7.4%
Profit per FTE	23.26	33.72	36.41	38.45	40.43	43.47
Operational Risk						
Profit volatility	16.2%	15.4%	15.0%	15.8%	20.5%	58.4%
Forecasting Risk (non adjusted ROE)	3.0%	6.7%	6.0%	4.5%	2.9%	1.0%
Coverage						
Interest Cover	1	10	35	82	1,163	265
Growth/Investment						
Capital renewal	143.0%	59.6%	71.3%	75.1%	88.0%	92.0%
Funds available for Distribution		-	4,000	8,000	9,000	9,000
Financial strength						
Gearing	14.1%	4.0%	0.4%	0.0%	0.0%	0.0%
Equity ratio (aka. Proprietorship)	68.0%	68.6%	72.0%	72.4%	71.1%	69.8%
Cash and Short Term Deposits ($000s)	-	-	-	743	260	606
Financial Debt ($000s)	14,641	3,839	343	-	-	-

* Agreed with Officials after adjustment in 2006/07 for restatement of certain land and buildings cost figures

Key: Statement of Corporate Intent indicators

6 OTHER MATTERS REQUIRED BY THE CRI ACT 1992

6.1. INFORMATION TO BE REPORTED TO SHAREHOLDERS

NIWA will provide information that meets the requirements of the:

- Crown Research Institutes Act 1992 (the Act);
- Companies Act 1993;
- Financial Reporting Act 1993;
- Crown Entities Act 2004; and
- New Zealand Institute of Chartered Accountants (NZICA) with regards to Generally Accepted Accounting Practice (GAAP).

The following information is made available to enable our shareholders to make an informed assessment of NIWA's performance:

- A Statement of Corporate Intent (SCI) which sets out NIWA's strategy for delivering against its core purpose and the company's financial and non-financial performance targets. The draft SCI is due not later than 1 month before the start of the financial year (31 May).
- An Annual Report containing sufficient information to allow an informed assessment to be made against the performance targets in the SCI. This report includes comments on our core business and how we communicate our science, financial statements (including audit report), and a report from the Directors to the shareholders. The Annual Report is to be provided within three months of the financial year ended 30 June. A public Annual General Meeting is to be held no later than six months after balance date and not later than 15 months after the previous AGM.
- A Half-Yearly Report containing unaudited financial statements (including comparatives of the same period in the previous year) and major highlights during the period. The Half-Yearly Report is due within two months of the first half of each financial year ended 31 December.
- A Quarterly Report containing information such as unaudited financial statements (including current quarter and year-to-date budgets and a forecast for the financial year ended 30 June). The Quarterly Report also includes financial performance measures and progress towards meeting non-financial performance targets. The Quarterly Report is currently requested within one month of each financial quarter ended 30 September, 31 December, 31 March, and 30 June.
- Any other information relating to the affairs of the company, as reasonably required by shareholders, under section 20 of the Act and section 45B of the Public Finance Act 1989.

6.2. POLICY AND PROCEDURE STATEMENTS

The following policies and procedures are required to be disclosed under section 16 of the Crown Research Institutes Act.

6.2.1 ACCOUNTING POLICIES

NIWA adopts generally accepted accounting practice in New Zealand as prescribed by the Institute of Chartered Accountants of New Zealand. The accounting policies for the measurement and reporting of financial performance, movements in equity, financial position, and cash flows are detailed in the Appendix.

6.2.2 DIVIDEND POLICY

The profit retention and dividend policy will be determined from year to year by the Board. The objective is to ensure that an appropriate level of funds is maintained in the company to sustain financial viability, whilst providing an adequate return to the shareholders. In considering this objective, the Board each year determines the level of surplus funds by reference to NIWA's:

- Medium- and long-term capital investment requirements (including equity investments);
- ability to maintain and expand operational capability;
- ability to repay debt (if any);
- funding requirements for subsidiaries;
- capacity to replace RV *Tangaroa* in event of loss;
- working capital requirements;
- legislative requirements, e.g., ensuring section 4 of the Companies Act 1993 (Solvency test) has been satisfied.

Any dividend would be paid within two months of the financial year-end. In-line with the expectations in the CRI Taskforce, NIWA will retain and reinvest surplus cash in capital expenditure. To this end, NIWA has budgeted to pay no dividend in 2011/12.

6.2.3 SHAREHOLDER CONSENT FOR SIGNIFICANT TRANSACTIONS

The Board will obtain prior written consent for any transaction or series of transactions involving full or partial acquisition, disposal, or modification of property (buildings, land, and capital equipment) and other assets with a value equivalent to or greater than $10 million or 20% of the company's total assets (prior to the transaction), whichever is the lesser.

The Board will obtain the prior written consent of Shareholding Ministers for any transaction or series of transactions with a value equivalent to or greater than $5.0 million or 30.0% of the company's total assets (prior to the transaction):

- the acquisition, disposal, or modification in a joint venture, partnership, or other similar association;
- the acquisition or disposal in full or in part of shares or interests in external companies, subsidiaries, and business units;
- transactions that affect the company's ownership of a subsidiary or a subsidiary's ownership of another equity;
- other transactions that fall outside the scope of the definition of the company's core business or may have a material effect on the company's science capabilities.

The Board will advise the Shareholding Ministers in writing (in the Quarterly Report) before entering into any transaction below this threshold related to property or to a specific commercialisation venture which involves change in intellectual property ownership or control.

6.2.4 RATIO OF SHAREHOLDERS' FUNDS TO TOTAL ASSETS

The target ratio of 'shareholder funds to total assets' is as follows:

	AS AT 30 JUNE					
	2011 FORECAST $000	2012 PLAN $000	2013 PLAN $000	2014 PLAN $000	2015 PLAN $000	2016 PLAN $000
NIWA GROUP EQUITY TO TOTAL ASSETS	0.68:1	0.69:1	0.72:1	0.72:1	0.71:1	0.70:1

Shareholders' funds are defined as the sum of the 'share capital' and 'equity reserves' (otherwise called 'total equity').

Total assets are defined as the sum of the net book value of 'current' and 'non-current assets'. This is 'as disclosed' in the company's balance sheet as per the Annual Report, prepared in accordance with the accounting policies adopted by the Board.

Shareholders' funds and total assets are averaged over two years.

6.2.5 COMMERCIAL VALUE OF THE SHAREHOLDERS' INVESTMENT

Section 16(3) of the Act requires the NIWA Group to furnish an estimate of the current commercial value of the Crown's investment.

The NIWA Board is satisfied that the net asset position (or shareholders' funds) as at 30 June 2010 is a fair and reasonable indication of the commercial value of the Group. The net asset position as shown in accordance with the company's accounting policies for 30 June 2010 was $89 million.

6.2.6 ACTIVITIES WHERE SHAREHOLDER COMPENSATION WOULD BE REQUIRED

The Board would look to seek compensation from the shareholders in the following circumstances:

- where the shareholders instruct NIWA to undertake activities or assume obligations that would result in a reduction of the company's profit or net realisable value;

- where the Board may consider undertaking strategic investments for the wider benefit of the New Zealand public, involving financial outlays beyond those incorporated within the company's Statement of Corporate Intent or financing capabilities.

No request for compensation is currently being sought from the shareholders. At this time no such investment has been identified, nor have any financial projections for such investment been included in NIWA's 2011/12 Statement of Corporate Intent.

6.2.7 OTHER MATTERS SPECIFICALLY REQUESTED BY THE SHAREHOLDER

There are no other matters that have been specifically requested by the shareholders.

The following information can be found on NIWA's website:

- Personnel policy that complies with the principles of a good employer
- Equal Employment opportunities programme
- Corporate social responsibility policy

Chris Mace
Chair

Craig Ellison
Director

APPENDIX:

DETAILED ACCOUNTING POLICIES

STATEMENT OF COMPLIANCE

The financial statements have been prepared in accordance with New Zealand generally accepted accounting practice (NZ GAAP). They comply with New Zealand equivalents to international financial reporting standards (NZ IFRS) and other applicable financial reporting standards appropriate for profit-oriented entities.

The financial statements comply with international financial reporting standards (IFRS).

BASIS OF PREPARATION

The measurement basis adopted in the preparation of these financial statements is historical cost, except for financial instruments as identified in specific accounting policies below. Cost is based on the fair value of consideration given in exchange for assets.

The presentation and functional currency used in the preparation of these financial statements is New Zealand dollars.

Accounting policies are selected and applied in a manner to ensure that the resulting financial information meets the concepts of relevance and reliability, ensuring that the substance of the underlying transaction or event is reported.

ACCOUNTING JUDGEMENTS AND MAJOR SOURCES OF ESTIMATION UNCERTAINTY

In the application of the Group's accounting policies, the directors are required to make judgements, estimates and assumptions about the carrying amounts of assets and liabilities that are not readily apparent from other sources. The estimates and associated assumptions are based on historical experience and other factors that are considered to be relevant. Actual results may differ from these estimates.

SIGNIFICANT ACCOUNTING POLICIES

The following significant accounting policies have been adopted in the preparation and presentation of the financial reports and have been applied consistently to all periods, unless otherwise stated.

a) Basis of consolidation

The Group financial statements incorporate the financial statements of the company and entities (including special purpose entities) controlled by the Company (its subsidiaries). Control is achieved where the Company has the power to govern the financial and operating policies of an entity so as to obtain benefits from its activities.

Non-controlling interests in the net assets of the consolidated subsidiaries may be initially measured either at fair value or at the non-controlling interest's proportionate share of the fair value of the acquirer's identifiable net assets. The choice of measurement basis is made on an acquisition-by-acquisition basis. Subsequent to acquisition, non-controlling interests consist of the amount attributed to such interests at initial recognition and the non-controlling interest's share of changes in equity since the date of the combination. Total comprehensive income is attributed to non-controlling interests even if this results in the non-controlling interests having a deficit balance.

The results of subsidiaries acquired or disposed of during the year are included in profit or loss from the effective date of acquisition or up to the effective date of disposal, as appropriate. Where necessary, adjustments are made to the financial statements of subsidiaries to bring the accounting policies used into line with those used by other members of the Group.

All intra-group transactions, balances, income and expenses are eliminated in full on consolidation.

Changes in the Group's interest's in a subsidiary that do not result in a loss of control are accounted for as equity transactions. Any difference between the amount by which the non-controlling interests are adjusted and the fair value of the consideration paid or received is recognised directly in equity and attributed to owners of the Company.

When the Group loses control of a subsidiary, the profit or loss on disposal is calculated as the difference between:

1. the aggregate of the fair value of the consideration received and the fair value of any retained interest; and
2. the previous carrying amount of the assets (including goodwill), and liabilities of the subsidiary and any non-controlling interests.

Amounts previously recognised in other comprehensive income in relation to the subsidiary are accounted for (i.e. reclassified to profit or loss or transferred directly to retained earnings) in the same manner as would be required if the relevant assets or liabilities were disposed of. The fair value of any investment retained in the former subsidiary at the date when control is lost is regarded as the fair value on initial recognition for subsequent accounting under NZ IAS 39 Financial Instruments: Recognition and Measurement or, when applicable, the cost on initial recognition of an investment in an associate or jointly controlled entity.

Investments in subsidiaries are recorded at cost less any impairment in the parent company's financial statements.

i. Accounting for jointly controlled operations

Where the Group has joint control in a jointly controlled operation, the Group recognises the assets that it controls and the liabilities that it incurs, along with expenses that it incurs and the Group's share of income it earns from the sale of goods and services by the joint venture.

ii. Accounting for Goodwill

Goodwill arising on the acquisition of a subsidiary or jointly controlled entity is recognised as an asset at the date that control is acquired (the requisition date). Goodwill is measured as the excess of the sum of the consideration transferred, the amount of any non-controlling interest in the acquiree and the fair value of the acquirer's previously-held equity interest (if any) in the acquiree over the fair value of the identifiable net assets recognised.

If, after reassessment, the Group's interest in the fair value of the acquiree's identifiable net assets exceeds the sum of the consideration transferred, the amount of any non-controlling interests in the acquiree and the fair value of the acquirer's previously-held equity interest (if any) in the acquiree, the excess is recognised immediately in profit or loss as a bargin purchase gain.

Goodwill is not amortised, but is reviewed for impairment at least annually. For the purpose of impairment testing, goodwill is allocated to each of the Group's cash-generating units expected to benefit from the synergies of the combination. Cash-generating units to which goodwill has been allocated are tested for impairment annually, or more frequently when there is an indication that the unit may be impaired. The recoverable amount is the higher of fair value less cost to sell and value in use. If the recoverable amount of the cash-generating unit is less than the carrying amount of the unit, the impairment loss is allocated first to reduce the carrying amount of any goodwill allocated to the unit and then to the other assets of the unit pro-rata on the basis of the carrying amount of each asset in the unit. Any impairment loss is recognised immediately in profit or loss and is not subsequently reversed.

On disposal of a subsidiary or jointly controlled entity, the attributable amount of goodwill is included in the determination of the profit or loss on disposal.

b) Revenue recognition

Rendering of services

Revenue from services rendered is recognised in profit or loss in proportion to the stage of completion of the transaction at reporting date. The amount of revenue unbilled is represented by 'uninvoiced receivables', which is stated at the proportion to the stage of completion in the statement of financial position. Revenue received but not earned is recognised as revenue in advance on the face of the statement of financial position.

Goods sold

Revenue from the sale of goods is measured at the fair value of the consideration received or receivable, net of returns and allowances. Revenue is recognised when the significant risks and rewards of ownership have been transferred to the buyer, recovery of the consideration is probable, the associated costs and possible return of goods can be estimated reliably, and there is no continuing management involvement with the goods.

Transfers of risks and rewards vary depending on the individual terms of the contract sale. For sales of instruments, transfer occurs upon receipt by the customer.

Dividend revenue

Dividend revenue from investments is recognised when the shareholder's right to receive payment has been established.

c) Government grants

Government grants are assistance by the government in the form of transfers of resources to the group in return for past or future compliance with certain conditions relating to the operating activities of the group. The primary condition is that the Group should undertake research activities as defined under the contractual agreements which award the funding.

Government grants relating to this funding are recognised as income in the profit or loss on a systematic basis in the equivalent period in which the expense is recognised.

d) Finance costs

Interest expense is accrued on a time basis using the effective interest method.

e) Goods and services tax (GST)

These financial statements are prepared on a GST-exclusive basis, except for receivables and payables, which are stated GST inclusive.

f) Employee benefits

Liabilities for wages and salaries, including non-monetary benefits and annual leave, long service leave, retirement leave and training leave are recognised when it is probable that settlement will be required and they are capable of being measured reliably. Provisions, in respect of employee benefits, are measured at their nominal values using the remuneration rate expected to apply at settlement. Employee benefits are separated into current and non-current liabilities. Current liabilities are those benefits that are expected to be settled within 12 months of balance date.

Provisions made in respect of employee benefits which are not expected to be settled within 12 months are measured at the present value of the estimated future cash outflows to be made by the Group in respect of services provided by employees up to the reporting date.

g) Impairment of tangible and intangible assets (excluding goodwill)

Intangible assets that have an indefinite life are not subject to amortisation and are tested annually for impairment. Other assets are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. If such an indication exists, the recoverable amount of the asset is estimated in order to determine the extent of the impairment loss. The recoverable amount is the higher of fair value less cost to sell and value in use.

If the recoverable amount of the asset is estimated to be less than its carrying value, the carrying value is reduced to its recoverable amount. An impairment loss is recognised in profit or loss.

Where an impairment loss subsequently reverses, the carrying amount of the asset is increased to the revised recoverable amount, but only to the extent that the increased carrying value does not exceed the carrying amount that would have been recognised if the asset had no impairment loss recognised in the past. This reversal is recognised in profit or loss.

h) Income tax

The income tax expense for the period is the tax payable on the current period's taxable income, based on the income tax rate for each jurisdiction. This is then adjusted by changes in deferred tax assets and liabilities attributable to temporary differences between the tax bases of assets and liabilities and their carrying amounts in the financial statements, and changes in unused tax losses.

Deferred tax is accounted for using the balance sheet liability method in respect of temporary differences arising from the carrying amount of assets and liabilities in the financial statements and the corresponding tax base of those items. Deferred tax liabilities are generally recognised for all taxable temporary differences. Deferred tax assets are generally recognised for all deductible temporary differences to the extent that it is probable that sufficient taxable amount will be available against which those deductible temporary differences can be utilised.

Deferred tax liabilities are recognised for the taxable temporary differences arising on investment in subsidiaries, associates and joint ventures, except where the consolidated entity is able to control the reversal of the temporary differences and it is probable that the temporary difference will not reverse in the foreseeable future. Deferred tax assets arising from deductible temporary difference from these investments are only recognised to the extent that it is probable there will be sufficient taxable profits against which to utilise the asset and they are expected to reverse in the foreseeable future.

Such assets and liabilities are not recognised if the temporary difference arises from the initial recognition (other than in a business combination) of other assets and liabilities in a transaction that affects neither the taxable profit nor the accounting profit.

Deferred tax assets and liabilities are measured at the tax rates that are expected to apply to the period when the asset and liability giving rise to them are realised or settled, based on the tax laws that have been enacted or substantively enacted at balance date.

Current and deferred tax is recognised in profit or loss, except when it relates to items recognised in other comprehensive income or directly in equity, in which case the deferred or current tax is also recognised in other comprehensive income or directly in equity, or where it arises from the initial accounting for a business combination. In the case of a business combination, the tax effect is taken into account in calculating goodwill or in determining the excess of the acquirer's interest in the net fair value of the acquiree's

identifiable assets, liabilities and contingent liabilities over the cost of the business combination. The carrying amount of deferred tax assets is reviewed at each balance date and reduced to the extent that it is no longer probable that sufficient taxable profits will be available to allow all or part of the asset to be recovered.

i) Purchased intangible assets

Purchased identifiable intangible assets, comprising copyrights, and software, are recorded at cost less amortisation and impairment. Amortisation is charged on a straight-line basis over their estimated useful lives. The estimated useful life and amortisation method are reviewed each balance date.

The estimated useful life for the copyrights is 5 years.

The estimated useful life for software is 1 year.

j) Development costs

Intangible assets which arise from development costs that meet the following criteria are recognised as an asset in the statement of financial position:

- the product or process is clearly defined and the costs attributable to the product or process can be identified separately and measured reliably;
- the ability to use or sell the product or process;
- the Group intends to produce and market, or use, the product or process;
- the existence of a market for the product or process or its usefulness to the Group, if it is to be used internally, can be demonstrated; and
- adequate resources exist, or their availability can be demonstrated, to complete the projects and market or use the product or process.

Capitalisation is limited to the amount which, taken together with any further related costs, is likely to be recovered from related future economic benefits. Any excess is recognised as an expense.

All other development and research costs are expensed as incurred.

Subsequent to initial recognition, internally generated intangible assets are reported at cost, less accumulated amortisation and accumulated impairment losses, on the same basis as purchased identifiable intangible assets.

k) Property, plant and equipment

Property, plant and equipment are stated at cost less accumulated depreciation to date less any impairment losses.

Expenditure incurred on property, plant and equipment is capitalised where such expenditure will increase or enhance the future economic benefits provided by the assets' existing service potential. Expenditure incurred to maintain future economic benefits is classified as repairs and maintenance.

The gain or loss arising on the disposal or retirement of an item of property, plant and equipment is determined as the difference between the sales proceeds and the carrying amount of the asset and is recognised in profit or loss.

l) Depreciation

Property, plant and equipment, except for freehold land and work in progress, are depreciated on a straight-line basis at rates estimated to write off the cost of the property, plant and equipment over their estimated useful lives, which are as follows:

Buildings & leasehold improvements	
Buildings	40 years
Leasehold improvements, freehold property	10 years
Leasehold improvements, rented property	5–12 years
Vessels	
RV *Tangaroa* hull	26 years
RV Kaharoa hull	16 years
RV Ikatere hull	20 years
Plant & equipment	
Plant & equipment	10 years
Scientific equipment	4 years
Electronic data processing equipment	
Supercomputer	8 years
Electronic data processing equipment	3 years
Office equipment	5 years
Furniture & fittings	10 years
Motor vehicles	4 years
Small boats	5 years

m) Receivables

Receivables are categorised as loans and receivables.

Loans and receivables are stated at amortised cost using the effective interest rate, less any impairment.

Collectability of receivables is reviewed on an ongoing basis. Debts which are known to be uncollectable are written off against the provision, once approved by the Board of Directors. A provision for doubtful debts is established when there is objective evidence that the Group

will not be able to collect all amounts due according to the original terms of receivables. Changes in the carrying amount of the provision are recognised in profit or loss.

n) Inventory

Inventory is stated at the lower of cost and net realisable value. Cost is calculated on the weighted average basis for consumables and first in first out (FIFO) for finished goods and work in progress.

o) Foreign currencies

i. Transactions

Transactions in foreign currencies are converted to the functional currency of New Zealand dollars, by applying the spot exchange rate between the functional currency and the foreign currency at the date of transaction. At the end of each reporting period, monetary assets and liabilities are translated to New Zealand dollars using the closing rate of exchange at balance date, and any exchange gains or losses are taken to profit or loss.

ii. Translation of foreign operations

On consolidation, revenues and expenses of foreign operations are translated to New Zealand dollars at the average exchange rates for the period. Assets and liabilities are converted to New Zealand dollars at the rates of exchange ruling at balance date. Exchange rate differences arising from the translation of the foreign operations are recognised in other comprehensive income and accumulated as a separate component of equity in the Group's foreign currency translation reserve. Such exchange differences are reclassified from equity to profit or loss (as a reclassification adjustment) when the foreign operation is disposed of.

Goodwill and fair value adjustment arising on the acquisition of a foreign operation are treated as assets and liabilities of the foreign operations and translated at the exchange rate ruling at balance date.

p) Leases

Leases are classified as finance leases whenever the terms of the lease transfer substantially of all of the risks and rewards of ownership to the lessee. All other leases are classified as operating leases.

The Group has not contracted for any leases which would be classified as finance leases.

Operating lease payments are recognised on a systematic basis that is representative of the benefit to the Group (straight line).

q) Statement of cash flows

The statement of cash flows is prepared exclusive of GST, which is consistent with the method used in the statement of comprehensive income. Operating activities comprise the provision of research services, consultancy, and manufacture of scientific instruments and other activities that are not investing or financing activities. Investing activities comprise the purchase and disposal of property, plant, and equipment, intangible assets, and advances to subsidiaries. Financing activities are those which result in changes in the size and composition of the capital structure of the Group.

Cash and cash equivalents comprise cash on hand, cash in banks and investments in money market, net of outstanding bank drafts.

r) Financial instruments

Derivative financial instruments:

The Group may use derivative financial instruments to hedge its exposure to foreign exchange and interest rate risks arising from operational, financing, and investing activities.

Derivative financial instruments such as forward exchange contracts are categorised as held for trading (unless they qualify for hedge accounting), and are initially recognised in the statement of financial position at fair value and transaction costs are expensed immediately. Subsequent to initial recognition, derivative financial instruments are stated at fair value. The gain or loss on re-measurement to fair value is recognised immediately in profit or loss unless the derivative is designated and effective as a hedging instrument in which event the timing of the recognition in profit or loss depends on the nature of the hedge relationship.

Other Financial assets:

Non-derivative financial assets comprise receivables, cash and cash equivalents, uninvoiced receivables, and intercompany and are initially recorded at fair value plus transaction costs (except for financial assets at fair value through profit or loss which are initially recorded at fair value).

Financial assets are classified into the following specified categories; classification depends on the nature and purpose of the financial asset and is determined at the time of initial recognition.

Financial assets at fair value through profit or loss:

- Financial assets are classified at fair value through profit or loss where the financial asset is either held for trading or it is designated at fair value through profit or loss.

A financial asset is classified as held for trading if:

- it has been incurred principally for the purpose of selling in the near future; or
- it is a derivative that is not designated and effective as a hedge instrument; or
- it is part of an identified portfolio of financial instruments that the Group manages together and has a recent actual pattern of short-term profit-making.

A financial asset other than a financial asset held for trading may be designated as at fair value upon recognition if:

- such designation eliminates or significantly reduces a measurement or recognition inconsistency that would otherwise arise; or
- the financial asset forms part of a group of financial assets or financial liabilities or both, which is managed and its performance is evaluated on a fair value basis, in accordance with either the Group's documented risk management or investment strategy, and information about the grouping is provided internally on that basis; or
- it forms part of a contract containing one or more embedded derivatives, and it is allowable to be designated at fair value through profit or loss.

Financial assets at fair value through profit or loss are classified as current assets and are stated at fair value, and changes resulting in a gain or loss are recognised in profit or loss.

Loans and receivables:

Loans and receivables have fixed or determinable payments and are not quoted in an active market. They arise when the Group provides money, goods or services directly to a debtor with no intention of selling the receivable. They are included in current assets, except for those with maturities greater than 12 months after the statement of financial position date which are classified as a non-current asset. These are subsequently recorded at amortised cost less impairment.

Impairment of financial assets:

Financial assets, other than those at fair value through profit or loss, are assessed for indicators of impairment at each balance date. Financial assets are impaired where there is objective evidence that, as a result of one or more events that occurred after the initial recognition of the financial asset, the estimated future cashflows of the investment have been impacted.

For certain categories of financial assets, such as trade receivables, assets that are assessed not to be impaired individually are subsequently assessed for impairment on a collective basis. Objective evidence of impairment for a portfolio of receivables could include the Group's past experience of collecting payments, an increase in the number of delayed payments in the portfolio past the average credit period of 60 days, as well as observable changes in national or local economic conditions that correlate with default on receivables.

For financial assets carried at amortised cost, the amount of the impairment is the difference between the asset's carrying amount and the present value of estimated future cashflows, discounted at the financial asset's original effective interest rate.

The carrying amount of the financial asset is reduced by the impairment loss with the exception of trade receivables, where the carrying amount is reduced through the use of an allowance account. When a trade receivable is considered uncollectible, it is written off against the allowance account. Changes in the carrying amount of the allowance account are recognised in profit or loss.

Financial liabilities:

Financial liabilities are classified as either financial liabilities at fair value through profit or loss or other financial liabilities. Financial liabilities are classified as at fair value through profit or loss where the liability is either held for trading or it is designated as at fair value. A financial liability is classified as held for trading if it meets similar criteria as financial assets held for trading.

A financial liability other than a financial liability held for trading may be designated as at fair value through profit or loss upon recognition if it meets similar criteria as financial assets designated as at fair value through profit or loss.

Financial liabilities at fair value are stated at fair value with any resultant gain or loss recognised in profit or loss. This incorporates any interest paid on the financial liability.

Other financial liabilities are initially measured at fair value through profit or loss, net of transaction costs. Other financial liabilities are subsequently measured at amortised cost using the effective interest method, with interest expense recognised on an effective interest basis.

The effective interest method is the method of calculating the amortised cost of a financial liability and of allocating interest expense over the relevant period. The effective interest rate is the rate that discounts estimated future cash payments through the expected life of the financial liability, or, where appropriate, a shorter period to the net carrying amount of the financial liability.

The Group derecognises financial liabilities when, and only when, the Group's obligations are discharged, cancelled or they expire.