

# GNS SCIENCE TE PŪ AO



## OUR STATEMENT OF CORPORATE INTENT

JULY 2020 – JUNE 2025



**OUR PEOPLE  
OUR SCIENCE  
OUR OUTCOMES**

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*Ō tātou tāngata  
Tō tātou pūtaiao  
Ō tātou putanga*




# MAI I TE RANGI, KI TE NUKU O TE WHENUA, KA PUTA TE IRA TANGATA I TE PO, I TE WHAIAO, I TE AO MARAMA. NAU MAI, HAERE MAI KI TE PŪ AO

*From the sky and the land came people,  
from the night, to the old world, to the world of light.  
Welcome to GNS Science*

 Mount Ruapehu, New Zealand | Setting up a laser scanner  
on Tukino skifield to study slope stability

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# INTRODUCTION FROM THE CHAIRMAN AND CEO

**We are pleased to introduce the GNS Science Statement of Corporate Intent for 2020-2025. It reaffirms GNS's strategic direction and our commitment to achieving a Cleaner, Safer, More Prosperous Aotearoa New Zealand, working in partnership with others, while growing our capability and financial sustainability.**

GNS Science has demonstrated scientific excellence for more than 150 years. We will continue to deliver globally influential science to become a truly world-leading science organisation, providing enduring research, analysis and advice that helps government, iwi/Māori, industry and the community to address challenges and enhance opportunities facing Aotearoa New Zealand now and into the future.

As a Crown Research Institute (CRI) our science direction reflects national and sector priorities. GNS is taking more of a leadership role in contributing to government-wide initiatives and science strategies and working in deeper collaboration with others to ensure that our science is useful, useable and used. We are well-positioned to respond to the evolving Government priorities for research, science and innovation in the *Kei Mua Te Ao* Research Science and Innovation Strategy.

GNS has been significantly affected by the response to the Covid-19 pandemic, and this Statement of Corporate Intent reflects the impact of the economic conditions that have deteriorated as a result. We are responding to the Covid-19 pandemic, including safeguarding the wellbeing of staff and maintaining financial sustainability. This means looking for new 'remote' ways to collaborate, exchange science results and innovations, and develop next-generation science capabilities.

The Whakaari eruption in December 2019 has also had a significant impact on GNS. Following the eruption, GNS supported the all-of-government response coordinated by the National Emergency Management Agency. This work demonstrated the value of the Crown's investment in the National Geohazards Monitoring Centre *Te Puna Mōrearea i te Rū*, and the expertise of

GNS's volcanologists. Investigations by the Coroner and WorkSafe into the eruption are ongoing, and we continue to provide information and expertise to support government agencies and the investigations.

Based on our four Science Themes, our work aligns with the national science and research priorities and supports global and domestic government initiatives. We are investing in multi- and interdisciplinary methods, such as Data Science and Social Science, to provide linkages and threads across our Science Themes and enable us to provide data-driven, outcome-oriented science for the benefit of all New Zealanders.

We cannot achieve our aims without an internal commitment to be the best organisation we can be. We will do this by fostering a positive organisational culture, being an employer and partner of choice, continuing to deliver high quality science, and coming up with smarter, faster ways to access and use our data. A key part of our strategy involves developing our diverse and inclusive workplace, including through gender equity; we cannot be ground-breaking and successful if we do not draw from the full pool of human talent. Through investing in and celebrating our people, we support the entire organisation to deliver information and knowledge that will help drive Aotearoa New Zealand's success.



# HE KUPU WHAKATAKI MAI I TE TIAMANA ME TE TUMUAKI

Vision Mātauranga is at the core of GNS Science's strategic framework and we remain committed to effectively implementing it. We will strengthen existing and new relationships with iwi/ Māori, grow Vision Mātauranga across our Science Themes, support the development of iwi-led research, and collaborate with other CRIs to develop Māori research and innovation capability. GNS Science will continue to build strong, meaningful relationships to better understand Māori science needs and expectations. Our aspiration is that Māori worldviews, priorities and needs are clearly visible and reflected in our ways of working, as well as our strategic direction.

Our work over the coming years will also be guided by the *Te Pae Kahurangi* review of CRIs, working closely with MBIE and other CRIs to ensure the outcomes of the review are implemented effectively across the science system.

The strategies and initiatives set out in this Statement of Corporate Intent position us to deliver on our aspiration for a Cleaner, Safer and More Prosperous Aotearoa New Zealand for current and future generations.



Dr Nicola Crauford  
Chairman



Ian Simpson  
Chief Executive



## VISION MĀTAURANGA

is at the core of GNS Science's  
strategic framework



# OUR PURPOSE

**GNS SCIENCE, TE PŪ AO, IS ONE OF SEVEN CROWN-OWNED RESEARCH INSTITUTES. AS THE NATIONAL INSTITUTE FOR GEOLOGICAL AND NUCLEAR SCIENCES, WE ARE FOCUSED ON DELIVERING BENEFITS FOR AOTEAROA NEW ZEALAND FROM NATURAL PROCESSES OCCURRING IN THE EARTH'S CRUST.**

**GNS SCIENCE'S CORE PURPOSE IS TO UNDERTAKE RESEARCH THAT:**

## **INCREASES**

New Zealand's resilience to natural hazards.

## **ENHANCES**

understanding of geological and Earth-system processes.

## **DRIVES**

innovation and sustainable economic growth in New Zealand's geologically-based energy and minerals industries.

## **DEVELOPS**

industrial and environmental applications of nuclear science.





# TŌ TĀTOU TUMANAKO

Our expertise contributes to a **Cleaner, Safer, More Prosperous Aotearoa New Zealand** by:

- understanding freshwater, energy and mineral resources to enable their wise custodianship and building of intergenerational wealth and wellbeing
- reducing the physical, economic and societal impacts of geological hazards, including through 'early warning' systems, improved hazard awareness and preparedness, enhanced geohazards monitoring, and enabling more resilient communities and buildings
- understanding past climates to improve global models that predict the future impacts of a changing climate, including critical tipping points
- developing and applying novel technologies such as nano-scale devices and isotope measurements to create new value for industry.

With around 450 staff at five sites across New Zealand, GNS Science draws on a heritage of over 150 years of excellence in Earth sciences.

We undertake a wide range of activities from basic research through to applied science, technology development and knowledge translation.

Our work is highly collaborative, with deep local and global partnerships across the full spectrum of our research. This partnering approach enhances our contribution to world-leading science and enables us to adapt it for Aotearoa New Zealand's benefit, to deliver highly relevant, tailored research, science and technology to central and local government, industry and iwi/Māori.

As Host of the *Resilience to Nature's Challenges* National Science Challenge, and as a lead contributor to its research programmes, GNS Science champions the value of cross-system and interdisciplinary research collaborations. To deliver meaningful solutions to those who most need our science, we form teams across institutions and research disciplines, reflective of the growing diversity of New Zealand society.

Our ongoing interactions and relationship with iwi/Māori whether they be post settlement governance entities or corporations are guided by key principles of the Treaty of Waitangi being participation; protection; and partnership.

From our interaction with iwi/Māori GNS Science continues to gain a rich picture of the Earth – by layering our scientific work with iwi/Māori narrative that reflects their relationship with the whenua and te taiao (partnership). Through our continued interactions and relationship we will endeavour to respond to opportunities relevant to Māori interests. We will be making a big step supporting iwi-led research (partnership), where iwi/Māori decide what is studied (participation) and what will be done with the results of their research (protection). We will gain a deeper understanding of mātauranga Māori and how it contributes to our work and vice versa. It will make future projects, partnerships and investment smoother and it will lead to quality research and excellent science.

# OUR CHANGING ENVIRONMENT

**The world in which we operate is ever-changing. By connecting with a wide range of collaborators, end-users and partners both locally and internationally, GNS Science aims to ensure our science keeps pace with major societal, scientific and technological changes, so we deliver excellent, relevant science that benefits Aotearoa New Zealand now and into the future.**

## COVID-19 IMPACTS

Science has been at the heart of Aotearoa New Zealand's response to the Covid-19 pandemic. The centrality of scientific evidence to government decision making has also highlighted the importance of our Crown Research Institutes in national emergency preparedness, response and recovery.

Like most sectors, science will be significantly affected by the impacts of Covid-19. Firstly, science is a global endeavour, particularly for the large-scale, complex Earth systems science core to GNS Science. GNS is highly interconnected with international science institutions, particularly for our geological hazards, climate change, Antarctic and Southern Oceans research. For now, we must find new 'remote' ways to collaborate, exchange science results and innovations, and develop next-generation science capabilities.

GNS Science is also highly dependent on international recruitment for our expertise, particularly earlier-career staff. With our CRI, University and wānanga partners, we will be working through how we can develop more 'home-grown' expertise and ensure that science remains a valued and accessible career for our increasingly diverse society.

Across the CRIs, the pandemic has highlighted a common purpose and set of challenges. We will seek to build on a growing sense of collaboration and commitment to cross-CRI approaches – already, the CRIs are working together to identify how best we might contribute to a sustainable, resilient and future-facing economic recovery centred on Kiwi innovation and ingenuity.

## RISK, RESILIENCE AND WELLBEING

The introduction in 2019 of a National Disaster Resilience Strategy recognises that New Zealanders live in a high-risk zone with an active plate boundary running directly beneath our feet. This produces geological hazard events that can have a significant impact on the country's economy and social wellbeing. GNS plays an important role in cross-system research to better understand and manage our exposure to natural hazards, with a focus on geological hazards but also including climate change impacts.

The awareness of New Zealanders about the impact of major geological hazard events has heightened in recent years with the Canterbury and Kaikōura earthquake sequences and Whakaari eruption. GNS Science is a lead provider of the deep geological sciences needed to inform emergency response to geological hazard events, as well as a recognised communicator of science about natural hazards.

Increasingly, our scientists are called upon to 'forecast' major hazard events and this is a focus of our planned work, as well as supporting the development of early-warning systems when possible.

The National Geohazards Monitoring Centre, hosted by GNS Science, is playing a vital role in providing around-the-clock monitoring of major geological hazards to help keep New Zealanders safe.



# TŌ TĀTOU TAIAO HURIHURI

## CHANGING EXPECTATIONS OF SCIENCE

Science is changing, not just in Aotearoa New Zealand, but globally too. The role of science in society is also changing, with new technologies and 'citizen science' bringing science closer to the everyday lives of New Zealanders. That brings opportunities, in that more of our communities are engaging with science and understanding its value in helping create the future. It also brings growing expectations of communication, participation and transparency in science.

Increasingly, science is being asked to deliver 'whole solutions' to complex issues. To address this, GNS Science is focusing on developing more effective interdisciplinary research and research collaborations that cross institutional boundaries. Increasingly, major stakeholders are participating more deeply in the research design and delivery, ensuring our research is useful, useable and used.

We are also building on our strengths to deliver independent science commentary that meets the needs of policy-makers, decision-makers and the public. This brings a sharper focus to science engagement and knowledge-brokering to diverse communities, including Māori. Vision Mātauranga is explicitly woven into all of our science programmes and demonstrates our commitment to developing effective science partnerships with iwi/Māori.

The draft Research, Science and Innovation (RSI) Strategy *Kei Mua Te Ao* sets out the Government's objectives for RSI in Aotearoa New Zealand and its role in delivering a productive, sustainable and inclusive future. The strategy signals future drivers for science in Aotearoa New Zealand. At its heart are three principles to effect change: excellence, impact and connections.

GNS Science is already responding to these and other drivers of change in the science and innovation system. Our refreshed strategic direction and investment in future-facing science and innovation is key to creating new economic value and increasing resilience, and means we are well-placed to respond to the current *Te Pae Kahurangi* review of the Crown Research Institutes.



📍 Ross Ice Shelf, Antarctica | Gravity meter reading, Antarctic Ice Dynamics project

# OUR DIRECTION

**Over the period of this Statement of Corporate Intent, we will build on our legacy of excellent science, focusing on national and sector priorities for a Cleaner, Safer, More Prosperous Aotearoa New Zealand. We are moving from an organisation of world-leading scientists to a world-leading science organisation, harnessing collective efforts for greater impact and benefit for Aotearoa New Zealand and globally.**

GNS Science undertook a major Strategic Review over 2018 and 2019, which refocused our science direction to capitalise on our core strengths and use our capability more effectively to respond to current and emerging stakeholder needs. We also refreshed our enabling corporate functions to improve support for our science programmes.

Our strategic direction is now better aligned to the priorities of New Zealand stakeholders in central and local government (our largest end-user sectors), major industry partners and iwi/Māori interests. Investing purposefully to ensure we are a strategy-led organisation is a key element of our approach.

Our outcomes-focused Science Themes are driving greater interdisciplinary research and helping broaden our research expertise beyond the physical sciences. Dedicated investment in Data Science, Vision Mātauranga and Social Science supports the development of these increasingly important capabilities. Ongoing leadership, learning and development and culture programmes are strengthening our organisation and will diversify our workforce over time, to meet future needs and aspirations.

# TŌ TĀTOU AHUNGA

## GNS SCIENCE STRATEGIC FRAMEWORK

The GNS Science Strategic Framework highlights our research direction and enables clear line-of-sight throughout the organisation. It shows how our Science Themes, ways of working, plans and performance are aligned to deliver benefits for Aotearoa New Zealand. Vision Mātauranga permeates all our activities, as we work in partnership with Māori on their science needs.



### WHY

#### A Cleaner, Safer, More Prosperous Aotearoa New Zealand

Our science enables a more sustainable environment and better quality of life for New Zealanders.

### WHAT

Unlocking the environmental, social, cultural and economic benefits through our work across four Science Themes:

- Natural Hazards and Risks
- Environment and Climate
- Energy Futures
- Land and Marine Geoscience

### HOW

Our four Strategic Pillars:

- Investing with Purpose
- Deep Partnering
- Decision Maker
- Growing Awareness

### WHO

Our whole organisation working together.

We connect and collaborate with stakeholders, government and industry to deliver fit-for-purpose science.

We partner with iwi/Māori to explore the science and innovation potential of Māori knowledge, resources and people to benefit all New Zealanders.

<sup>1</sup> The New Zealand Treasury Living Standards Framework covers four capitals: Natural, Human, Social and Financial/Physical  
<sup>2</sup> The potential temperature increase above pre-industrial levels



# OUR SCIENCE

## Excellent science, where it matters most

We have made clear, strategic choices about the areas of research we will prioritise and invest in over the next five years, to progress towards a **Cleaner, Safer, More Prosperous Aotearoa New Zealand**.

Through our four Science Themes, we will build on the strong foundations of our world-renowned expertise to contribute international thought-leadership and deliver practical solutions of high relevance to our major stakeholder sectors and end users.

We are also investing in multi- and inter-disciplinary methods, such as Data Science and Social Science, to provide linkages and threads across our Science Themes and enable us to provide data-driven, outcome-oriented science for the benefit of all New Zealanders.

Each Science Theme is underpinned by our Strategic Science Investment Fund (SSIF) programmes that provide long term strategic research to support end-to-end science delivery along the value chain (Appendix 1).



# TŌ TĀTOU PŪTAIAO

## MEASURING OUR SCIENCE PERFORMANCE

Our Science Theme priorities were identified using an outcome-oriented approach and following stakeholder engagement. The global and national drivers, focus and impacts of the four Science Themes are described in more detail in the following sections, along with the measures that will demonstrate the impacts of our work over the next five years. The overall performance of GNS Science is monitored against the set of GNS Science Key Performance Indicators (KPIs) shown in Appendix 2.

## EXTERNAL ADVICE

Our Strategic Scientific and User Advisory Panel has an important role in evaluating both our science quality and delivery for and with stakeholders. Reporting directly to our Board, the Panel meets annually to review our performance, future research directions and capability needs to ensure our research is both excellent and relevant, and that we are taking advantage of key developments in international science and technology. In 2019/20, we refreshed membership of the Panel to ensure more future-focused independent advice to the Board. This year we will look to add Māori and environment sector representation on the Panel.



Updating the Ruapehu and Ngauruhoe Taiping Site volcano webcam and communications hub



# NATURAL HAZARDS AND RISKS



## Research priority areas:

- Managing risk to the four capitals
- Enabled and informed public, community and business
- Effective early warnings and forecasts
- Improved response decision-making and recovery planning
- Improved risk governance

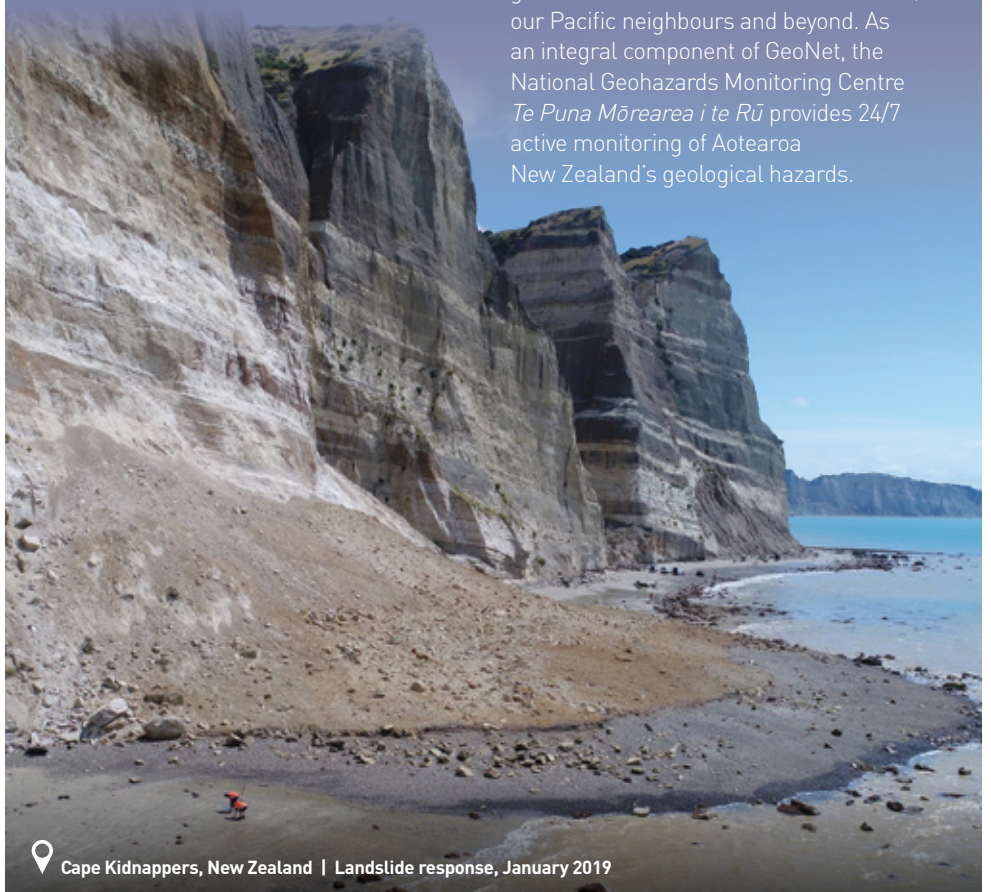
## THE CHALLENGE

Natural hazards and their consequences are part of the 'DNA' of New Zealand. Increasingly the risks imposed by earthquakes, volcanoes, tsunami and landslides are compounded by weather events and the additional stresses of climate change. At the same time, the impacts of hazard events are intensifying through population growth and aging, continued urbanisation, and business vulnerabilities of fast-moving consumer goods and just-in-time supply chains. Risk is increasing and Aotearoa New Zealand's ability to manage future impacts from natural hazards is being tested.

## GNS'S ROLE

GNS Science has a national leadership role for research on the causes, risks and consequences of geological hazards. We have extensive scientific knowledge in Earth processes, and globally and nationally recognised expertise in hazard and risk modelling, forecasting socio-economic impacts of events, and system modelling of consequences and resilience options. We apply our Social Science capability to increase community resilience, improve risk communication and develop tools for hazard preparedness.

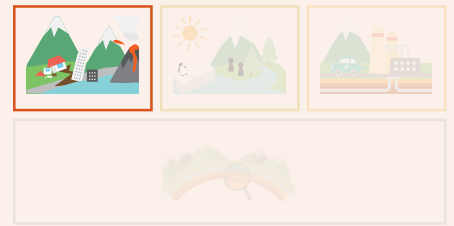
Through GeoNet we are building on nearly two decades of operations and are looking for new opportunities to deliver even greater benefit to Aotearoa New Zealand, our Pacific neighbours and beyond. As an integral component of GeoNet, the National Geohazards Monitoring Centre *Te Puna Mōrearea i te Rū* provides 24/7 active monitoring of Aotearoa New Zealand's geological hazards.



📍 Cape Kidnappers, New Zealand | Landslide response, January 2019



# NATURAL HAZARDS AND RISKS



## WORKING TOGETHER

GNS is working across the system as a major coordinator of key research providers and data suppliers in the university, CRI, central and local government and private sectors. Our work involves collaboration with a wide range of users, through engagement with communities, iwi/Māori, industry bodies, government agencies and the hazard management sector, and communication through multiple channels to ensure stakeholders understand and manage the risks in their areas/roles.

The Natural Hazards and Risks theme, which works closely with the *Resilience to Nature's Challenges* National Science Challenge, also works with Centres of Research Excellence and other major collaborative programmes, to ensure that GNS's work complements and adds value to the work of others across the New Zealand science and innovation system. Our aim is to facilitate an integrated view of 'who is doing what,' leading to a coherent scientific evidence base for hazard risk management.

## RESILIENCE TO NATURE'S CHALLENGES NATIONAL SCIENCE CHALLENGE

GNS Science hosts *Resilience to Nature's Challenges*, one of 11 National Science Challenges. The mission of the Challenge is to accelerate Aotearoa New Zealand's natural hazard resilience.

Phase 2 of the Challenge commenced in July 2019 and is focused around two major themes that align with the National Disaster Resilience Strategy.

The Multi-hazard Risk Model comprises exciting new research to advance our understanding of natural hazard processes (such as earthquakes and tsunamis, volcanoes, coastal hazards, high impact weather, and wildfires).

The Resilience in Practice Model comprises mātauranga Māori, Social Science, and engineering research, to develop policies, tools and methods to ensure new resilience knowledge becomes part of daily decision making in Aotearoa New Zealand.

As in Phase 1, the Challenge has brought together high quality research teams from CRIs, universities and research organisations across the country, and end-users are being engaged from the outset to ensure research outputs are useful and usable.

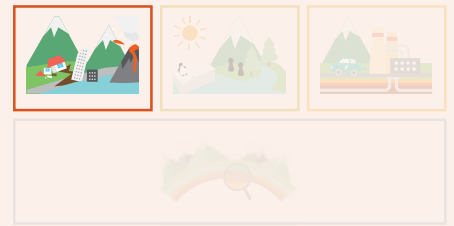


The National Geohazards Monitoring Centre *Te Puna Mōrearea i te Rū* provides

# 24/7

active monitoring of New Zealand's geological hazards.

# NATURAL HAZARDS AND RISKS



## BUILDING THE KNOWLEDGE BASE

GNS takes a deliberate approach to building the national knowledge base through custodianship of a number of nationally significant databases (Appendix 3). The National Earthquake Information Database, NZ Volcano Database, Regional Geological Map Archive and Data File, and the NZ Fossil Record File, as well as generation of primary data relating to earthquake, tsunami, volcano and landslide are particularly relevant to the Natural Hazards and Risks theme. Through GeoNet and research across GNS, this growing knowledge base is used to better understand the processes that manifest as geological hazards and ensure world-class risk management advice to maintain New Zealanders' wellbeing and livelihoods in the face of natural hazard challenges. We are increasingly looking to apply Data Science methods to improve our ability to forecast geological events.

## RESEARCH DIRECTION

Our research aims to generate critical scientific knowledge for the benefit of Aotearoa New Zealand and drive its uptake and use to improve resilience to natural hazards at national, regional, business, community and individual levels.

Our five outcome-oriented programmes span the full value chain of information, from underpinning knowledge to better understand Aotearoa New Zealand's natural hazards, through to risk management options to help communities mitigate their destructive effects and advise on policy and regulation.

## NATURAL HAZARDS AND RISKS IMPACTS AND PRIORITIES 2020-25

### 1. Managing Risk to the Four Capitals (Natural, Human, Social, Financial/Physical)

- Developing national hazard models for earthquake, volcano, tsunami and landslide.
- Understanding the fragility of the built environment to geological hazards.
- Calculating risk to lives, livelihoods, business, and infrastructure from natural hazard events.
- Integrating natural hazard risks and their secondary impacts (e.g. landslides, floods, fire and liquefaction) with weather risks and the stresses associated with climate change.

### 2. Enabled and Informed Public, Community and Business

- Understanding how people think about hazard and risk, and the vulnerabilities of different groups in society including cultural context and values.
- Developing effective communication and visualisation methods of the threats and impacts of future events.
- Understanding the capacity in communities, and the public and private sector to manage risk and adopt adaptive pathways to risk mitigation.

### 3. Effective Early Warnings and Forecasts

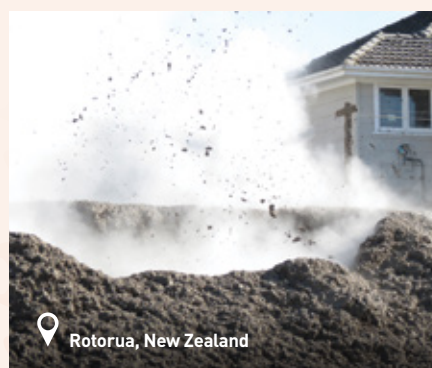
- Visualisation of event scenarios, effective evacuation planning and event forecasts.
- Understanding behavioural responses to warnings and forecasts.
- Using new technologies to improve event forecasts.

### 4. Improved Response Decision-Making and Recovery Planning

- Improved GeoNet and wider hazard event information.
- Improved policy and planning scenarios and exercises with stakeholders for recovery including build-back-better options.

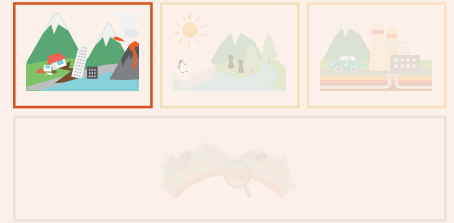
### 5. Improved Risk Governance

- Reviewing building, planning, and resource management codes, guidance, standards, legislation and policy to assess alignment of risk management controls.
- Socio-economic risk models to inform resilience investments.
- Evidence-based decision-making processes and decision support tools to inform an "all-risks" approach to risk governance arrangements.



Views of hydrothermal eruption

# NATURAL HAZARDS AND RISKS



## RESEARCH OUTPUTS 2020/21

**Progress towards measures of success are delivered through the following research outputs in the coming year:**

1. Improved understanding of earthquake rupture processes, ground motions, frequency and magnitude characteristics, spatial and temporal distributions and interactions, and the underlying tectonic processes operating in Aotearoa New Zealand to inform the refresh of the National Seismic Hazard Model.
2. Deliver improved laboratory and field-based models of submarine landslides, rainfall triggering thresholds for NZ debris flows and site specific conditions and performance of fill slope urban areas under earthquake and rainfall.
3. Develop conceptual and numerical models of NZ volcanoes, which along with field data, will inform hazard maps and decision support tools for life safety and asset management decision making.
4. Continue with RiskScape 2.0 product development and improve the interoperability and multi-hazard capability of this platform with other domestic and global risk tools.
5. Publish and socialise the major update of the National Tsunami Hazard Model among the stakeholder community.
6. Deepen understanding of interdependencies between critical infrastructures which may result in compounding hazard impacts, using Wellington and Hawkes Bay as a case study.
7. Assisting district and regional councils to understand gaps, challenges, opportunities in improved hazard risk management for improved resilience and wellbeing outcomes.
8. Develop and test a protocol to assess iwi management plans for their natural hazard and risk provisions.
9. Support the translation of science into accessible forms for community understanding and empowerment for risk management and resilience, including visual tools and products.
10. Understand community reactions to forecasts and warnings and adjust communications for enhanced effect.
11. Deliver improved monitoring capability in line with the outcomes specified in the Enhanced Geohazards Monitoring Contract.
12. Landslide forecast models will be incorporated into National Geohazards Monitoring Centre (NGMC) advice to stakeholders, allowing the near-real time forecasting of landslide occurrence and severity in future earthquakes.
13. Further develop a framework for post-event assessments, create scientific response plans, plans for transition to recovery, and explore rapid modelling through to long-term monitoring tools to cover the transition from response to recovery.
14. Refine and secure enduring governance, contracting and funding arrangements for the GeoNet programme. This includes stakeholder agreement to the GeoNet product and service catalogue and service level measurement.
15. Adoption by Department of Conservation (DoC) of GNS-sourced risk assessment procedures ensuring decision making on exposure of staff and visitors to natural hazards across the DoC estate.

## MEASURES OF SUCCESS

**By June 2021**, enhanced provision of fast, accurate and effective information (through Geonet) to responsible agencies/stakeholders, along with planning for response and recovery via scenarios and exercises before events happen will greatly enhance resilience.

**By June 2023**, new and improved decision support tools (through the National Seismic Hazard Model) to determine balanced risk management using the ACTA (avoid, control, transfer, accept) framework are widely used.

**By June 2024**, research will have identified how people, communities and businesses think about hazard and risk, and from that developed effective methods for uptake and appropriate actions responding to warnings and forecasts of natural hazard events.

**By June 2024**, our assessments of the effectiveness of building, planning and resource management codes, guidance, standards, legislation, policy, land use, business continuity, and integrated planning and advocacy for revisions where appropriate, will have improved risk governance arrangements in Aotearoa New Zealand (through RiskScape 2.0).

**By June 2025**, values, attitudes and behaviours of individuals, communities and businesses, in responding to hazard risk information and warnings are understood and factored into decision making.



## ENVIRONMENT AND CLIMATE



### Research priority areas:

- Our groundwater systems
- Antarctica in a 2°C world
- Ecosystem response to a warming world
- Revealing the drivers of our climate
- Carbon cycle dynamics
- Our rising tide

### THE CHALLENGE

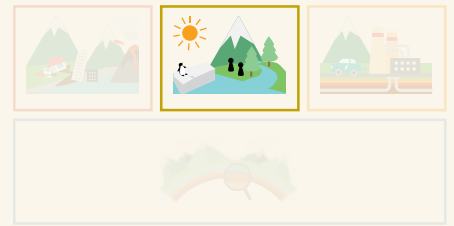
Groundwater availability and quality is fundamental to life in Aotearoa New Zealand. We have extensive aquifers – 40% of our people depend on groundwater for drinking water, and 80% of the annual river flow comes from groundwater. This natural resource is critical in sustaining aquatic ecosystems and cultural values, such as mahinga kai. While its value is clear, we do not fully understand the extent of our groundwater system or the processes that affect water quality and availability, like the impact of land use practices, the relationship between groundwater and surface waters, and interaction with geothermal water. We need to map, quantify, and monitor our systems to better manage risks as our population grows and demand for groundwater increases. We need to improve our ability to model our groundwater systems to better predict their response to changing land use and climate.

Climate change is a global reality. Temperatures are on track to reach 1.5°C warmer than pre-industrial temperatures between 2030 and 2052. Warming is likely to continue to increase through the 21<sup>st</sup> century, unless large emissions reductions are achieved. We need to improve our ability to predict how our climate may change and identify tipping points and thresholds in the system so that we can reduce or avoid climate surprises. We need to find ways to measure and account for our greenhouse gases while developing mechanisms to reduce our emissions. We need to adapt to unavoidable change as our oceans warm, pressure on freshwater resources increases, sea level rise affects coastal communities and infrastructure, and extreme weather events become more common and intensify.



Fox Glacier, New Zealand | View down the Fox Glacier in April 2019

## ENVIRONMENT AND CLIMATE



### GNS'S ROLE

We are establishing a more comprehensive understanding of freshwater systems to provide new insights and improve policy, management and restoration approaches. New technologies and science methods enable us to better document Aotearoa New Zealand's groundwater resource and evaluate its vulnerabilities. Using a values-based approach, we will make sure that our research is fit-for-purpose for those who need it.

Our Earth system scientists uncover geological data to extend our environmental knowledge well beyond the short but detailed datasets collected from instruments over recent decades. Earth's long-term environmental archives allow us to examine how our marine and terrestrial ecosystems, coastal environments, and Antarctica's ice sheets, responded during previous intervals of time when average surface temperatures were like those we will experience in the coming decades. This insight improves our ability to anticipate and adapt to future change.

We have world-leading expertise in analysing and monitoring carbon budgets for our major New Zealand cities, to better inform decisions on emissions mitigation approaches. Our proven capability in air particulate matter research enables us to monitor air quality and guide local government in better understanding and managing air contaminants and their sources.

As sea levels rise, we must understand the effects on our coastlines and the communities living there. By studying the response of our coastal systems to previous episodes of warmer-than-present climate and major environmental change we anticipate how coastal ecosystems will change in the future. Our work on ice sheets allows us to reduce uncertainty

regarding the rate and magnitude of sea level change. By measuring and modelling coastal land movement we can provide location specific sea level projections for planning and adaptation to rising or falling seas.

### WORKING TOGETHER

GNS Science is part of the National Groundwater Research Alliance, a platform which brings together all Aotearoa New Zealand's research providers. Working alongside regional council partners and the Ministry for the Environment, the Alliance provides a coordinated and strategic approach to identify and resolve groundwater research priorities and enable sustainable management of Aotearoa New Zealand's precious water resources.

As part of a wider system of environmental and climate change research, we are committed to deepening collaborations with selected research teams nationally and internationally to achieve better outcomes. In part, this will be achieved through cooperative research enabled by various large-scale research initiatives like the National Science Challenges (e.g. *Our Land and Water, Deep South*), the Antarctic Science Platform, and joint initiatives with other environmental CRIs, such as the National Environmental Data Service.

Working in more connected ways will enable our research contributions in groundwater, air quality and climate change to complement efforts by others. Together, we will develop and refine more accurate environmental and climate models and forecasts, more effectively communicate expected future impacts, and provide tailored guidance, models and tools to mitigate the risks to and from our changing natural world.

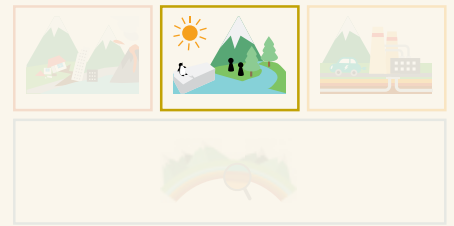
**80%**

of the annual river flow comes from groundwater.

### BUILDING THE KNOWLEDGE BASE

We will continue to develop and enhance our Nationally Significant and other environmental science databases and collections (e.g. Geothermal and Groundwater Databases, New Zealand Fossil Record File database, and the National Paleontological Collection). This will increase access to, and use of, information on Aotearoa New Zealand's natural resources and biological heritage to more accurately understand and manage our groundwater, restore our natural environment, and identify potential pressures on our ecological systems as climate warms and sea levels rise.

# ENVIRONMENT AND CLIMATE



## RESEARCH DIRECTION

Our research focuses on groundwater resources, sea level rise, climate change impacts on ecosystems, and the carbon cycle. Working with our major partners, we have designed our programmes to meet their current and future needs.



Hokianga, New Zealand

Obtaining sediment core for analysis, Hokianga Sedimentation Project

## ENVIRONMENT AND CLIMATE IMPACTS AND PRIORITIES 2020-25

### 1. Our Groundwater Systems

- Measuring, mapping and modelling groundwater systems.
- Recognising the social, environmental and cultural value of Aotearoa New Zealand's groundwater.

### 2. Antarctica in a 2°C World

- Developing and improving understanding of how ice shelves, ice sheets and sea ice will change as temperatures increase and how this will impact the Southern Ocean and Aotearoa New Zealand.

### 3. Ecosystem Response to a Warming World

- Enhancing tools and models to increase understanding of the effect of previous episodes of climate change on plankton in our oceans and native terrestrial flora.
- Characterising the state of our lake systems prior to the influence of human activity and analysing the signals of environmental change in these systems.

### 4. Revealing the Drivers of Our Climate

- Generating highly resolved records of past climate from sediment layers and ice cores to identify and examine patterns not currently captured in short-term datasets (e.g. thermometers and satellites).
- Identifying thresholds and tipping points in the climate system to improve our ability to model and project future climate.

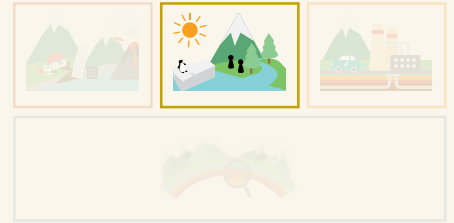
### 5. Carbon Cycle Dynamics

- Improving Aotearoa New Zealand's national and regional carbon budgets, so that New Zealand can meet its global commitments.
- Examining carbon uptake and/or release in the Southern Ocean and land-based ecosystems.

### 6. Our Rising Tide

- Understanding the causes, rate, and magnitude of past, present, and future sea level change and its impact on Aotearoa New Zealand and the South Pacific.
- Connecting our ice sheet research with global sea level datasets and coastal vertical land movement to improve regional projections of sea level.
- Incorporating sea level research results into groundwater, coastal hazard and risk models to guide climate change adaptation policy and planning.





## RESEARCH OUTPUTS 2020/21

**Progress towards measures of success are delivered through the following research outputs in the coming year:**

1. Rapid build model methodologies developed – for local model builds and new model areas, including groundwater source protection zone modelling.
2. Freshwater resource management options (e.g. related to land use and water allocation) and their effects on groundwater have been tested with regional councils in at least two case studies, by utilising advanced modelling (e.g. methods encompassing uncertainty) and characterisation techniques (e.g. remote-sensed imagery analysis).
3. Identification and mapping of iwi/hapū values for the Heretaunga Plains for use in resource management decision making processes (e.g. cultural connections and ecosystem health indicators).
4. Outputs from ice sheet model simulations that incorporate new ice shelf melt parameters are incorporated into updated sea level projections.
5. Techniques in automated microscopy are tested and improve the rate and reproducibility of data acquisition for ecological modelling studies and other geoscientific applications.
6. A new statistical coastal inundation model for a Pacific Island is developed.
7. The first estimate of Auckland’s full carbon budget is provided.

## MEASURES OF SUCCESS

**By June 2021**, 20% of our (~150) coastal aquifers have been mapped, measured, and modelled.

**By June 2021**, new sea level projections are incorporated into coastal hazards guidance.

**By June 2023**, the carbon budgets across our four major urban centres are accurately monitored.

**By June 2023**, improved climate projections are integrated into national climate change policy and at least one Regional Plan.

**By June 2024**, a revised ocean model is being used to simulate future changes in primary productivity in the oceans around Aotearoa New Zealand.

**By June 2025**, estimates of sea level rise commitments from Antarctic ice sheet melt are integrated into at least one long-term environmental management plan.

# ENERGY FUTURES



## Research priority areas:

- Improved understanding of geothermal systems
- Improved sustainable use of geothermal energy
- New materials for energy applications

## THE CHALLENGE

Energy powers our economy and underpins the wellbeing of our communities. Energy generation and how energy is used are inextricably linked to environmental impacts, including greenhouse gas emissions. Like other countries, Aotearoa New Zealand is grappling with how it can meet increasing demands for energy, without causing irreversible changes to our environment. There is growing demand for low-carbon energy supply and more equitable access to energy resources.

Aotearoa New Zealand has committed to a path with net-zero carbon emissions by 2050. Currently energy use based on hydrocarbon products are a significant contributor to Aotearoa New Zealand's greenhouse gas emissions. Science can play a critical part in identifying and developing innovative solutions to reduce the emissions of CO<sub>2</sub> to the atmosphere from energy production and use.

## GNS'S ROLE

As 'the Energy CRI', GNS Science plays a major role in enabling Aotearoa New Zealand's transition to a low-carbon energy future. The solutions that result from our research will reduce our national carbon footprint, while enhancing New Zealand's energy security and economic competitiveness.

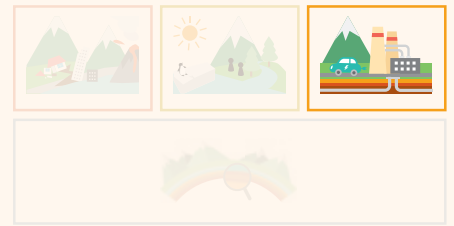
We invest in diverse research to grow Aotearoa New Zealand's renewable energy supply, develop new materials for producing and storing hydrogen, and reduce energy-related emissions.

Our expertise in understanding the geological framework of the country is essential to assess the feasibility of future energy potential from deeper geothermal resources, and also to maximise opportunities for business, iwi/Māori and the community from 'direct use' of geothermal heat. In order to inform decision-making at all levels, we communicate evidence-based advice to our stakeholders about future energy resources and current resource availability, as well as the implications of resource use, including social and cultural impacts.

Efficient use of renewable energy is another area where our science contributes to the way Aotearoa New Zealand reduces its carbon emissions. We focus our research in new materials to reflect increasing demand for new technologies, processes and materials that reduce energy demand (and carbon-intensity) and develop new paradigms for energy generation on the supply-side.



Reporoa, New Zealand | Geothermal sampling



## WORKING TOGETHER

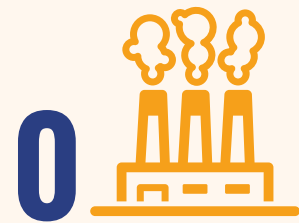
In line with Government goals to grow private-sector-led R&D activity, over the next three years we will foster external partnerships which will focus our research where there is high industry demand. This will assist New Zealand industry and homes to transition to low-carbon emissions. We expect our research in this area to be central to GNS Science's work that will enable the creation of new, high-value industries in Aotearoa New Zealand and also develop new value streams for export.

Through our thought leadership and robust science, we are well placed to ensure that Aotearoa New Zealand understands the opportunities and risks relating to a changing energy mix into the future. We will play an important role in bringing a science voice to national conversations alongside central and local government, industry, iwi/Māori and community interests.

## BUILDING THE KNOWLEDGE BASE

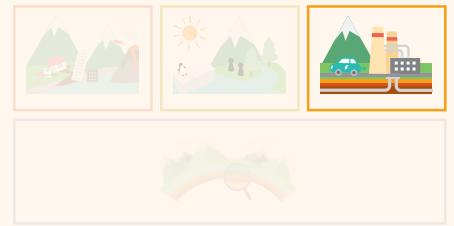
By drawing on more than 60 years of government exploration of, and research on, Aotearoa New Zealand's geologically based energy resources our research increases understanding of the geological and flow processes that contribute to the transport of fluids and heat to the geothermal areas of the central North Island.

This work will also build on new data for the Taupō Volcanic Zone collected in the Land and Marine Geoscience programmes. These data will advance the conceptual understanding of the transport processes that lead to the formation of the geothermal systems that are found at the surface.



Aotearoa New Zealand has committed to a path with net-zero carbon emissions by 2050.





## RESEARCH DIRECTION

Our research aims to increase opportunities to use renewable resources and efficiency gains to reduce carbon emissions from energy use and to grow energy resource security. This will be achieved through increased use of geothermal energy for electricity generation, direct use of geothermal energy, improvements in hydrogen production, the development of enabling technology to increase the use of renewable energy and the identification of new energy sources that contribute to a low-emissions energy future.



Mercury Energy geothermal power station

## ENERGY FUTURES IMPACTS AND PRIORITIES 2020-25

### 1. Improved Understanding of Geothermal Systems

Understanding near-surface geothermal resources

- Acquire geoscience data on low enthalpy, near surface geothermal systems through field surveys including geology, geophysics and geochemistry.
- Developing numerical models that can be used to delineate resources, assess sustainability and encourage direct use of Aotearoa New Zealand's geothermal resource.

Knowledge of high-enthalpy geothermal resources

- Enhancing understanding of hydrothermal systems and their heat sources from depth to surface in the Taupō Volcanic Zone.
- Developing a comprehensive 3D model of the Taupō Volcanic Zone, with an emphasis on geology, geochemistry, and hydrodynamics of the heat sources and associated hydrothermal properties.

Superhot Geothermal Fluids

- Combine many disciplines to develop new methods for characterising the deep superhot resource in the Taupō Volcanic Zone.
- Enhance understanding of the transfer from source to surface of heat and gases.

### 2. Improved Sustainable use of Geothermal Energy

Reducing Risks Associated with Geothermal Developments

- Developing new methods for integrating and analysing datasets and models to reduce uncertainty and risk for geothermal developments.

Improved Reservoir Modelling

- Improve methods for predicting the future state of geothermal systems and the surrounding environment in response to extraction of fluid and energy.

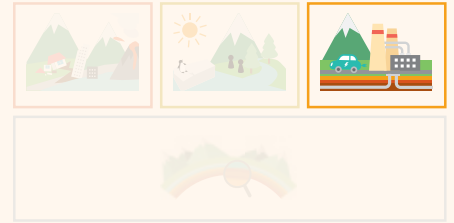
### 3. New Materials for Energy Applications

Energy Efficiency and Storage

- Developing novel materials to improve the efficiency of green hydrogen production from electrolysis by focusing on the synergistic use of physical and chemical techniques to modify the surface properties of materials.

Energy Innovations

- Develop novel, proof of concept innovations for new ways of generating and sustainably using energy using our world-class materials science expertise.



**RESEARCH OUTPUTS 2020/21**

**Progress towards measures of success are delivered through the following research outputs in the coming year:**

1. Findings from an exploration drilling programme are integrated into a multi-disciplinary 3D geoscience model that supports decision making for the future development of a power plant.
2. The Rotorua 3D geoscience model will be updated with new environmental monitoring data to support the Bay of Plenty Regional Council in the management of the Rotorua Geothermal Field.
3. A model of the breakdown of a geothermal tracer will be developed and applied to a previously conducted tracer test.
4. New surface modification methods show a significant improvement in energy efficiency of a heat exchanger system (such as in a refrigerating appliance) or in efficiency of food processing systems. At least one method is identified and presented to a next- or end-user.
5. A prototype electrolysis system for hydrogen production has been developed.
6. GNS will identify key social factors that impact Aotearoa New Zealand’s energy future, paying particular attention to trade-offs between different societal values around energy use.

**MEASURES OF SUCCESS**

**By June 2021**, GNS will develop an energy research strategy and roadmap that: produces scenarios of likely energy use together with emissions profiles; identifies key challenges these scenarios create for Aotearoa New Zealand; identifies new research initiatives that will address these challenges and ultimately support Aotearoa New Zealand’s transition to a secure, sustainable, low-emissions energy future.

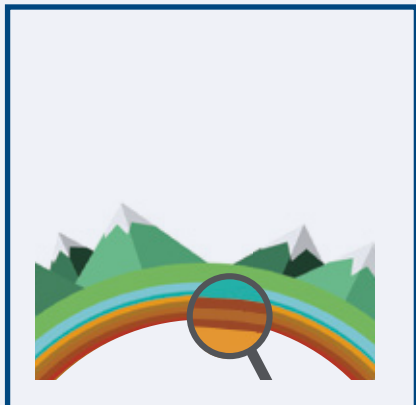
**By June 2022**, a new resource assessment model is being used to increase renewable electricity generation from geothermal energy.

**By June 2023**, new geoscience data and modelling of low enthalpy geothermal systems are being used to unlock greater direct use of geothermal energy.

**By June 2024**, R&D created by GNS Science is taken up and used by at least one primary industry or manufacturing company.

**By June 2025**, new geothermal tracers and reservoir models will be available to determine the reservoir temperatures between reinjection and production wells.

# LAND AND MARINE GEOSCIENCE



## Research priority areas:

- Thermal processes
- Plate boundary tectonic processes
- Continental tectonic processes
- Surface geological processes
- Databases/geoscience information

## THE CHALLENGE

Te Riu-a-Māui / Zealandia is Earth's eighth continent. It forms the surface landscape and continental shelf areas under Aotearoa New Zealand's jurisdiction – extending over nearly 5 million square kilometres. New Zealand has continental scale challenges, opportunities and stewardship responsibilities for this large area of the South Pacific. Science research has a crucial role in determining how successfully Aotearoa New Zealand manages understanding global-scale environmental change, variability and impacts, improving predictive capability for hazards and disasters, identifying new sustainable resources, and developing transformational new technologies to facilitate new activities.

## GNS'S ROLE

Fundamental geoscientific research undertaken by GNS Science plays an essential part in providing an accurate and up-to-date framework for Aotearoa New Zealand's natural geological and biological environment. It also adds to iwi/Māori knowledge of culturally, environmentally and economically significant solid earth materials and processes.

Deeper knowledge of fundamental Earth deformation and plate boundary structure and processes is critical for research on the causes and impacts of geological hazards such as earthquakes, landslides and volcanoes. As we develop greater understanding of the planet's dynamic processes we will be able to strengthen our resilience to risk.

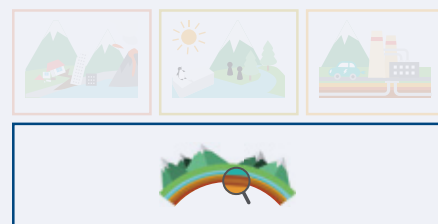
In a low-carbon future, there will be continuing demand for a sustainable, secure supply of energy and "critical" mineral resources. GNS work provides accurate appraisal of Aotearoa New Zealand's on-land and offshore resource potential to enable sustainable custodianship of the continent's natural resources.



Seafloor absolute pressure gauges lashed to the deck of R/V *Roger Revelle*, during a study of the Hikurangi subduction zone



## LAND AND MARINE GEOSCIENCE



### WORKING TOGETHER

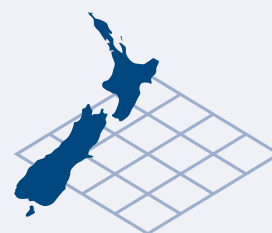
GNS Science nationally coordinates geoscience research initiatives, collaborating with New Zealand government agencies, universities, CRIs, iwi/Māori, and other providers, and leads international initiatives of benefit to Aotearoa New Zealand. Our participation in major international collaborative consortia, for example, the International Ocean Discovery Program and the International Continental Drilling Program, enables us to grow capability, leverage co-funding and brings to New Zealand significant new knowledge and critical thinking, as well as additional scientific infrastructure and equipment.

Land and Marine Geoscience research and data underpins and complements research in other GNS Science Themes: it provides a wider context for tectonic and volcanic hazards, delivers an improved framework for energy and mineral resource management, and supplies a richer perspective on current and future environmental change.

### BUILDING THE KNOWLEDGE BASE

Discoverable and accessible data, information, and collections will underpin a wide variety of research applications, models and real-world impacts in GNS Science, and more broadly across the New Zealand science system. An informed government, industry, iwi, and society with Earth Sciences data and information will enable better decisions.

As the national geological sciences agency in Aotearoa New Zealand, we hold more than 150 years of knowledge about the continent of Te Riu-a-Māui / Zealandia and exercise scientific custodianship of national datasets. Our Nationally Significant Collections and Databases are precious taonga that underpin Te Riu-a-Māui / Zealandia's heritage and history. We are committed to facilitating use of our data and communicating our knowledge across New Zealand society.



New Zealand's jurisdiction over Te Riu-a-Māui / Zealandia extends over nearly

# 5 million km<sup>2</sup>



Field activities at Discover Hidden Worlds Geocamp, Pahiatua

# LAND AND MARINE GEOSCIENCE



## RESEARCH DIRECTION

We are investing in an extensive research programme to address fundamental questions about the composition and architecture of the continent Te Riu-a-Māui / Zealandia and understand the geological processes that have shaped it. Our foundation programme aims to close critical knowledge gaps that relate to societal challenges including undertaking research on the physical processes that control geohazards, characterising natural resources and appreciating the consequences of past environmental change.

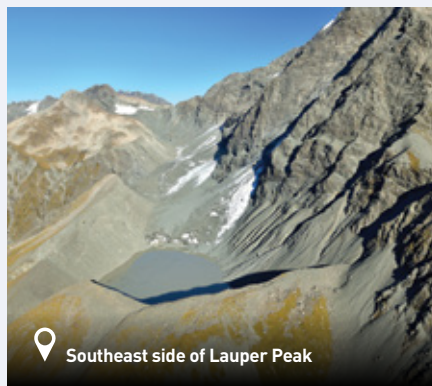
## LAND AND MARINE GEOSCIENCE IMPACTS AND PRIORITIES 2020-25

### 1. Improved Resilience to Natural Hazards

- Increasing understanding of geohazards by interpreting plate boundary processes and resolving physical controls on the generation of earthquakes, tsunamis and volcanic eruptions.

### 2. Managing Natural Resources Sustainably

- More accurately characterising the composition and structure of Te Riu-a-Māui / Zealandia spatially and over time.



Glacial trough, now occupied by a melt lake.



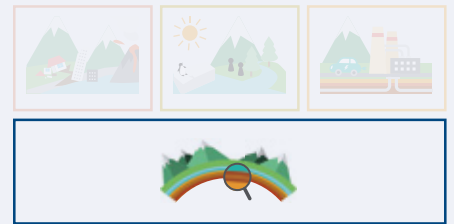
Radiocarbon dating process for determining age of kauri wood

### 3. Adapting to Changing Climate

- Understanding the consequences of past ocean and climate change on Te Riu-a-Māui / Zealandia by acquiring baseline paleo-environmental data.

### 4. Wider Use of Collections and Databases

- Enabling our most important underpinning databases and collections to be widely, efficiently and confidently used to deliver new insights and context for applied geoscience, education, policy setting, community engagement and industry benefit.



## RESEARCH OUTPUTS 2020/21

Progress towards measures of success are delivered through the following research outputs in the coming year:

1. New insights into the slip behaviour of the Hikurangi subduction plate boundary are scientifically documented.
2. Results of major GNS programmes investigating the structure of, and earthquake activity on, the Hikurangi margin are effectively communicated to key stakeholders.
3. New geological and geophysical data are published for the Taupō Volcanic Zone and the Colville-Kermadec volcanic systems and their implications are communicated to key stakeholders.
4. Understanding of surface sedimentation and geochemical processes in coastal and urban environments is improved through sampling, analysis and predictive numerical modelling.
5. Paleo-environment and timescale interpretations from critical, warmer than present, climate intervals of sediment cores are distributed in the form of data reports and manuscripts.
6. Zealandia-wide paleogeography compiled and submitted for publications to provide a framework for paleoenvironmental research.
7. GNS's eight Nationally Significant Collections and Databases (NSCDs) meet FAIR Data Principles; **Findable** and **Reusable** through metadata and licensing, **Accessible** through server availability and **Interoperable** via community standard formats as appropriate.
8. GNS's important natural hazard datasets are assessed for their current levels of FAIR Data Principles compliance and a roadmap established to achieve full compliance.

## MEASURES OF SUCCESS

**By June 2021**, our Nationally Significant Collections and Databases meet FAIR Data Principles, as appropriate, with growing usage by industry, research bodies and iwi/Māori.

**By June 2022**, greatly improved characterisation of potential for Hikurangi subduction earthquakes and their likely impacts is provided for natural hazard risk assessment.

**By June 2023**, underpinning paleo-environmental information from the South West Pacific, Antarctica, and Aotearoa New Zealand is available for use in climate assessments and policies.

**By June 2024**, tectonic, geological and geophysical information is utilised for marine and land use planning and decision making.

**By June 2025**, our important geological hazard databases meet FAIR Data Principles, as appropriate, and are routinely used by government, industry and Māori for risk mitigation strategies and practice.



## Innovative, multi-disciplinary approaches

**By using multi- and inter-disciplinary methods, we aim to extend the impact of our science, gain new insights and deepen the value and usability of our science for society. Through increased investments in Social Science and Data Science, we will also ensure strong linkages across our four Science Themes.**

### SOCIAL SCIENCE

To maintain social, environmental, economic and cultural well-being in Aotearoa New Zealand's geological landscapes, we have to understand the interplay between geological resources and processes, and the people who live on and with them. Through a better appreciation of how society functions including governance and policy frameworks, we expect there will be a greater uptake of the physical science that GNS Science invests in, to ensure our research results are useful, usable and used.

We continue to successfully apply our Social Science expertise to mitigate risks and build resilience to natural hazards by understanding how to influence individuals, communities, and organisations, including Māori resilience frameworks. We are now working to embed Social Science approaches across our Science Themes to better understand public perceptions and values, identify barriers to adopting new practices and technologies, and ensure effective public discussion on critical issues.

Social Science is an integral element for delivering increased impact across the Science Themes. We are actively exploring opportunities for Social Science to elevate the impact of our science through investment in a strategic plan to embed and integrate Social Science methods across our Science Themes.

#### KEY INITIATIVE FOR 2020/21:

- Social Science is increasingly embedded in our Science Themes through internal engagement and strategic planning.

### DATA SCIENCE

Leading-edge techniques and expertise in Data Science (including Deep Learning, Decision Support Models, Data Lens, and trust in Artificial Intelligence) can be applied across our Science Themes to make the most of our information and insights. These are applied to all GNS databases (many of which are nationally significant), GeoNet and satellite data to address science problems with artificial intelligence and machine learning methods.

We are investing in Data Science, firstly to build capability and capacity in relevant disciplines, and secondly to integrate Data Science approaches across the Science Themes. This enables us to extract more value from GNS's significant data resources, for the benefit of the wider science community, and to deliver greatest value and impact for Aotearoa New Zealand.

#### KEY INITIATIVES FOR 2020/21:

- Broaden the uptake of Data Science approaches through an internal funding round supported by the Capability Development Fund.
- Update the GNS data management plan to include new data streams and developments in National Data Services across the CRIs.



📍 Sampling at Champagne Pool, Waiotapu, near Rotorua

## How we work – Pehea Tā Tātou Mahi

**Our four Strategic Pillars signal how we want to work to achieve continued growth and success for GNS Science and to deliver greater value and impact. They serve as focus areas for shaping our culture, guiding our decision making and priorities, as well as assessing the effectiveness of our organisation.**

### INVESTING FOR AND WITH PURPOSE

**We focus our work on meeting New Zealand’s needs**

We will gear our activities to making a difference for Aotearoa New Zealand and be transparent and accountable with our investments. We will be more purposeful in how we invest our science capabilities and our funding will be strategy-led. We are actively managing our non-contestable funding from the Strategic Science Investment Fund (SSIF) to make the most of our strengths and as a springboard for other revenue opportunities. We will be clear about our priorities to increase the impact of everything we do, across the scientific world, for the benefit of Aotearoa New Zealand.

### DECISION-MAKER

**We use our knowledge to influence stakeholder decisions**

We will improve our connections with a wide range of stakeholders in government, business and communities to proactively become part of the decision-making agenda. We want to be at the table to contribute meaningfully in the conversations about Aotearoa New Zealand’s future. We will have more confidence to get involved with key stakeholders to influence their decisions – talking to the right people, in the right way, at the right time.

Our teams are empowered to make decisions and will proactively explore opportunities with our stakeholders. It’s about situational awareness to know when, with whom and how we might have influence and then going for it.

 <p><b>Me āta whakangao, me whakangao hoki mō te whāinga</b> Investing for and with Purpose</p>	 <p><b>He Kaiwhakatau</b> Decision maker</p>	 <p><b>Kia whai hoa rangapū tūturu nei</b> Deep Partnering</p>	 <p><b>Te Aroā</b> Awareness</p>
<p>Ko tā tātou e arotahi nei, kia mahi hei whakatutuki i ngā hiahia o Aotearoa We focus our work on meeting New Zealand’s needs</p>	<p>Ka whakamahia tā tātou mōhiotanga hei whakaaweawe i ngā whakataua tā tātou hunga whaipānga We use our knowledge to influence stakeholder decisions</p>	<p>Ka whai hoa rangapū tātou mō te momoho pūmau We partner for long-term success</p>	<p>Ka para te huarahi kia whakamihia tātou mō ngā mahi pai e oti ana tātou We build recognition for the great work we do</p>



## DEEP PARTNERING

### We partner for long-term success

This means building significant relationships that can be identified as long-term – where there's value in engaging, building trust and working together for mutual long-term benefit. It can involve conscious decisions to collaborate rather than compete in a contestable funding environment.

Our relationships with other Crown Research Institutes, universities, local and central government, industry and business, iwi/Māori, and international science organisations enable us to work together in making Aotearoa New Zealand a Cleaner, Safer and More Prosperous place to live. A good example is our work on the RiskScape modelling tool in partnership with NIWA, the lead CRI for research on weather-related hazards.

We will build on great iwi/Māori relationships that have endured over time, collaborations with other CRIs and researchers that maximise the value of the work to Aotearoa New Zealand, and develop ongoing projects with commercial clients to respond to their changing needs.

## AWARENESS

### We are recognised for the great work we do

We want to raise awareness of who we are and what we do so we can engage New Zealanders in the significance of our work. This will be done with a compelling shared narrative that puts us firmly in the science space where we are uniquely placed and strong.

As we demonstrate the benefits of our work and build trust with our partners and communities, they will recognise the value that we add and advocate for us.

This means our people will be active in places where we can have influence. Internally we are creating and fostering pride in the breadth and depth of what we do, and what others say about us, so we can celebrate together.





# VISION MĀTAURANGA



## WORKING IN PARTNERSHIP

Māori success is Aotearoa New Zealand's success. GNS Science's drive to embed Vision Mātauranga in our work is about unlocking, in partnership with Māori, the science and innovation potential of Māori knowledge, resources and people to benefit all New Zealanders.

We are committed to developing partnerships with iwi/Māori interests and entities to identify and deliver primary science needs that best contribute to the social, economic, cultural and environmental wellbeing of Aotearoa New Zealand.

### EMBEDDING VISION MĀTAURANGA IN OUR WORK

Vision Mātauranga is at the core of our GNS Science Strategic Framework. GNS Science continues to be committed to growing our ability to effectively implement and support Vision Mātauranga in our work. We will do this by:

- Extending our engagement strategy to
  - Strengthen existing and new relationships with iwi/Māori
  - Build and implement Vision Mātauranga within our broad GNS themes
  - Continue to develop robust research innovation inclusive of iwi in the bids process
- Supporting the development of iwi-led research and development strategies
- Collaborating with other CRIs to develop whole-of-government approaches, including engagement with educational providers to develop Māori research and innovation capability
- Developing our capability and capacity to support Vision Mātauranga and our relationships with iwi/Māori.

Through our ongoing engagement with Māori interests, our focus will be to continue building strong, meaningful relationships so that GNS Science can better understand Māori science needs and expectations. This quality engagement will build firm relationships and equip us to work in partnership with iwi/Māori on agreed priority areas of research. Our aspiration is that Māori worldviews, priorities and needs are clearly visible and reflected in our organisational ways of working, as well as our strategic direction.

As we continue to build our relationships with iwi/Māori, we will increase our visibility within te ao Māori and the integration of te ao Māori within GNS Science, supporting our commitment to increase Māori capacity and capability within our organisation.

#### KEY INITIATIVES FOR 2020/21:

- Extend our Engagement Strategy to enhance and strengthen our relationship with iwi/Māori.
- Continue to develop our capability and capacity to support Vision Mātauranga and our relationships with iwi/Māori.

# OUR ORGANISATION

## Organisation Wide Priorities

**GNS Science spent considerable time and effort in the 2019/20 year responding to the Whakaari eruption and the Covid-19 pandemic. We will continue to respond to the impacts of these events and use any learnings to improve the way we undertake our business. We will also continue to provide expertise to support government agencies and investigations into the Whakaari eruption and response and meet our ongoing responsibilities.**

Our work over the next year will also be guided by both the *Te Pae Kahurangi* review of CRIs which took place in the 2019/20 year and the recommendations from GNS Science's Strategic Scientific and User Advisory Panel (SSUAP) review of our science programmes. Both of these reviews will play a role in ensuring our science continues to have a focus on excellence and relevance, and that we are well attuned to national and international trends and opportunities.

### KEY INITIATIVES FOR 2020/21:

- Position the organisation to appropriately respond to the Covid-19 pandemic, including safeguarding the safety and wellbeing of staff and maintaining financial sustainability.
- Work closely with MBIE and other CRIs, as appropriate, to ensure that the outcomes from the CRI Review are implemented effectively across the system, and to implement any GNS-specific feedback.
- Respond to the demands of various investigations into the Whakaari eruption and implement recommendations from the investigations as appropriate.
- Construct the roadmap for GNS Science's future science needs informed by our organisational strategic goals, stakeholder interests, and capability mapping.
- Deliver a suite of strategic projects to support organisational capability development around our science themes and enabling programmes.



Calling camp by satellite phone during the Antarctic Ice Dynamics project, Ross Ice Shelf, Antarctica

# TŌ TĀTOU ROOPŪ WHAKAHAERE

## Valuing Our People

**Our people are our greatest asset – it is the work we do using our collective skills and experience that drives our success. We work as a team (both internally and externally) in collaborative relationships to meet our strategic goals and deliver value to Aotearoa New Zealand.**

Our investment and planning is clearly linked to our strategic outcomes. This means that we are building capability and diversity, ensuring our workforce is aligned to our strategy, investing in learning and development and focusing on Health and Safety.

### THE VALUE OF DIVERSITY

We are actively seeking diversity in our workforce, reflecting the cultural and societal diversity in Aotearoa New Zealand. We are committed to creating an inclusive research environment that will contribute to our research productivity and impact, as well as strengthen the relationship between science and society.

Already, 30% of our staff come to us from other countries and we value the breadth of views and experience this brings to our work and interactions. We also recognise the need for greater representation of Māori staff to enhance our capability and capacity to support Vision Mātauranga and our engagement with iwi/Māori.

We believe that being a good employer means that a clear career path, staff retention, and a safe place to work are only part of the story. Our continuing focus is on a welcoming culture that is highly collaborative and inclusive, where people can innovate and learn from one another. This is vital for us to compete for talent in Aotearoa New Zealand and internationally.

As part of this work, we have established an Early Career Network. We are implementing a programme that has been designed by the Network to enhance connectivity among our early-career people and provide development opportunities in ways that meet their needs.

### CAPABILITY PLANNING AND DEVELOPMENT

Investing in the development of our people is fundamental to our ongoing success and ability to deliver transformational science.

Leadership development and strategic workforce planning are key areas for our organisation. In a rapidly changing world, our leaders must be equipped to build the capability of their teams, lead our culture, and champion new ways of thinking and operating. Our workforce planning needs to equip us for the future with the skills and capabilities available when we need them.

### CULTURE AND ENGAGEMENT

Following on from a major organisational restructure, we have reviewed our strategic direction and key drivers and made a clear decision to 'hold our course'. This means we are focusing on embedding new expectations and ways of working and driving forward the organisational culture that we believe will hold us in good stead for the future. We have developed a set of Values that reflect who we are, what we value and what we expect of people that work at GNS.

We will measure our progress on this journey through staff surveys, supported by targeted actions to develop the culture that will best support the achievement of our strategy. Key areas of focus to enhance our capability, make us easier to work with

and develop our culture are captured in our People and Culture Strategy which has a short-medium term focus on:

- **Workforce planning** – to ensure we have the right capability to meet the needs of the future
- **Leadership development** – growing leaders at all levels of the organisation, ensuring they are equipped with the skills to lead, coach and develop those they are responsible for
- **Strategic attraction and recruitment** including initiatives such as the Māori Intern programme will support and develop the skills required for the future, including a focus on growing the number of Māori entering the science sector through study or further research and fostering a culture of shared learning, along with developing other diversity opportunities
- Ongoing implementation of the **Culture Change Plan**
- **Building diversity and inclusion** into 'the way we do things here' through systematic approaches to all aspects of engaging, leading and managing our people
- **Performance management** – which includes reward and recognition and working to apply the Gender Pay Principles and close gender pay gaps.

### KEY INITIATIVE FOR 2020/21:

- Implement our People and Culture Strategy, including delivery of leadership programmes, strategic workforce planning and shaping the diversity of our workforce.



## Health and Safety

**Providing and supporting a safe and productive work environment is central to our beliefs. The Covid-19 pandemic put our approach to the test, and our people responded well – adjusting to working remotely in (often challenging) home environments.**

The need to ensure mental wellbeing took precedence during the lockdown period, and the importance of a safe and supportive work environment was continually reinforced to staff.

This year we have increased capability within the Health and Safety team to support our focus on improving systems, structure, documentation and processes.

Good progress is being made, and the results of the health and safety component of our Staff Survey were encouraging – GNS Science was 16% above the WorkSafe benchmark in relation to health and safety behaviours, and 8% above the benchmark in relation to attitude. The survey results have provided good data to help steer our efforts going forward.

Overall, we are committed to ensuring our staff have the capability, as well as the behaviours, that will ensure they look after each other and get home safe every day.

### KEY INITIATIVES FOR 2020/21:

- Continue to implement structured and systematic approaches to better manage critical Health and Safety risks.
- Continue to build our safety focused culture.

## Connectivity and Innovation

**We continue to roll out new programmes to deliver meaningful value with and for our major stakeholders. This includes implementing a new Stakeholder Engagement programme and engaging our major partners and end-users earlier in the research process.**

GNS relies heavily on international research collaborations and partnerships to deliver high quality research outcomes through the leveraging of international capability and large-scale facilities. We maintain this through strategic agreements with other national geoscience and isotope science agencies in Australia, Japan, Germany, Italy and the USA. We also hold strategic national memberships that enable national access to collaborative resources, including the International Ocean Discovery Program (IODP) and the International Continental Drilling Programme (ICDP).

The Innovation Hub within GNS Science will continue to provide internal mechanisms and incentives to support higher-risk innovation and co-design approaches to develop new research directions. This includes hosting innovation workshops, allocating capability development funds to encourage co-design approaches to new research directions and allowing higher-risk initiatives to be tested. While the Innovation Hub activity is mostly virtual, we are working towards developing innovation spaces to support ideation and the development of an innovation community of practice across GNS.

We will continue to develop our approach to commercialisation and IP management – recognising that both ‘open science’ and

industry-led innovation are needed to grow new industries and value-streams for Aotearoa New Zealand.

Given the significant impact of Covid-19 on our major stakeholders and the way in which we can engage with them, key areas of focus include:

- Progressing and adapting our **Stakeholder Engagement** programme
- Integrating stakeholder survey findings into the development of **new engagement approaches**
- Exploring **new digital methods** to deliver value to customers
- Progressing our collaborative research agreements with **major international partners**, including Geoscience Australia
- Continuing to **engage in key international forums**, and building leadership in major international collaborations, including IODP and ICDP.

### KEY INITIATIVES FOR 2020/21:

- Adapt external stakeholder engagement approaches to reflect both the impacts of Covid-19 and stakeholder needs.
- Allocate capability development funds to help drive our innovation practices



Te Mata Peak, Hawke's Bay

Groundwater spouting from tap

## Information Technology

**Science is a data-driven activity. GNS holds nationally- and in some cases globally-significant data resources, models and associated technologies to unlock their value.**

Our use of data-centred technology will directly impact on how well we can realise our strategic approach to fulfil our potential as a world leading science organisation. Increasing our influence, impact and relevance nationally and internationally, and sustaining our ability to do large-scale collaborative research, requires that our Information Systems Strategy, capability and enterprise systems are fully integrated to maximise delivery opportunities.

GNS is investing in its ICT systems and infrastructure to ensure that we are well-positioned to take advantage of the growing opportunities across the New Zealand science and innovation system for high-performance computing and associated Data Science opportunities.

Key elements of our Information Systems Strategy are:

- **Collaboration and knowledge dissemination** – providing better tools and practices, with a focus on dataset availability and management, will enable our people to work from any external organisation or scientific disciplines to deliver shared goals
- **Organisational intelligence and efficiency** – providing better contract, project, financial and performance management information across our organisation. This involves improved information flow management tools and practices

- **ICT infrastructure modernisation** – continuing our programme of consolidation and redesign of the GNS ICT infrastructure to better provide resiliency, immediacy, scalability and cost savings
- **Continuing development of our people** to improve data literacy and the application of Data Science across the organisation.

### KEY INITIATIVES FOR 2020/21:

- Develop a recommended solution for an Enterprise Resource Planning (ERP) and contract management tool for GNS
- Refresh of the www.gns.cri.nz website purpose, platform and content
- Support and implement the changes from the NZRIS project as required



A 3D model of the Wairau Plains aquifers

## Financial Services

**Financial Services support GNS in achieving financial sustainability through the delivery of a range of accounting and financial services, including transactional processing, financial and management information reporting, development of the budget and business plans, and providing information and advice to project leaders and managers throughout GNS that supports strong decision making.**

GNS faces significant disruption to business-as-usual and ongoing financial uncertainties. While we are working to assess the impacts of Covid-19 on GNS, managing the scale of the impact will require focused financial leadership, including improved financial monitoring, reporting and advice.

We completed an upgrade of our finance system last year and are currently focused on improvements to financial reporting and project management reporting. In 2020/21, we will work with other interested CRIs to identify options for a new long-term integrated management systems solution, which will include new Finance, Project Management, Resource Planning, and Asset Management systems (see also Information Technology section).

### KEY INITIATIVES FOR 2020/21:

- Complete the development of a recommendation for a long-term replacement of the finance system as part of the ERP initiative (noted under Information Technology).
- Continue improvements to the current finance system to enhance financial reporting to management, Board and external stakeholders.
- Continue to improve the capability of the financial services team to deliver improved analysis and information for decision making.
- Select and implement a new time record management system.

## Property Assets

**We are currently engaged in a comprehensive review of our property and infrastructure, with the objective of completing a Property Development Strategy in 2020/21.**

A Property Strategy will provide a high-level framework for coordinated planning across our national portfolio of research laboratories, workshops, office accommodation and public interface property. It will integrate the operation, maintenance, improvement, adaption, construction and disposal of buildings and infrastructure. It will be set within the context of the people, places, processes and technologies required to create a built environment that underpins the delivery of our science.

Key areas of focus include:

- **Improving our maintenance and renewal programme**, so that our buildings meet science and research requirements
- **Completing asset management planning** to allow us to optimise maintenance renewal and improvement decisions
- **Aligning our property investment** with our organisational strategy and direction
- **Assessing our future capability needs**, and the physical refreshment, repurposing, refitting or replacement of GNS Science buildings and infrastructure.

### KEY INITIATIVES FOR 2020/21:

- Finalise the development of the GNS Property Strategy, including recommendations for the direction of future property and infrastructure investments.
- Complete a multi-year asset management plan aligned to the Property Strategy preferred direction.

### PHOTOGRAPH ACKNOWLEDGEMENTS

Karen Britten	Cover, P28, 36
Margaret Low	Inside front cover, P34, 35
Colin McDiarmid	P3
Richard Johnson	P5
Jenny Back	P7, 32
Marie Helliwell	P10
Regine Morgenstern	P12, 30
Brad Scott	P14
Dougal Townsend	P16, 26
Kyle Bland	P18, 25
Agnes Mazot	P20
Simon Addison, Mercury Energy	P22
Justin Ball, University of Colorado	P24
Glenn Evans	P26



📍 Monthly sampling at Te Wai ā-moe, (Crater Lake), Mount Ruapehu



# FINANCIAL FORECASTS

**This financial forecast has been developed at a time when economic conditions have significantly deteriorated due to the Covid-19 pandemic, and the timing of the future recovery is difficult to predict.**

It is also an important period for GNS, coming from a Strategic Review and reorganisation, to strengthen the capability and further improve performance in both science and non-science areas. There is a critical need for ongoing investment to continue the strategic direction of GNS, but this comes at a time when the financial situation is unfavourable.

GNS has responded to the uncertainty by taking a relatively conservative view on the revenue forecasts in the short term. In the out-years it is anticipated that commercial revenue will improve and by 2023 recover to the same levels experienced prior to Covid-19. The underlying organisational costs of GNS have been restricted in the short term to levels below 2020, in order to provide as much capacity as possible for new initiatives, but increasing in out-years in line with revenue recoveries.

The financial situation for both 2020 and 2021 has been significantly strengthened through the assistance of the government, firstly with additional funding for SSIF of \$5.2m (for 4 years), and a Covid-19 relief grant of \$4.2m for 2020 and forecast for 2021. This funding has provided the necessary financial capacity to continue many of the important initiatives needed for the future.

In addition to government funding, GNS requires sustainable and profitable commercial revenue in New Zealand and overseas, which reflects alignment with stakeholder needs and priorities. Commercial revenue projections from national and international sources, in the short to medium term, are under strain due to the impacts of Covid-19 but we anticipate a slow recovery in out-years.

The resulting forecast financial results are for a small surplus in each of the next 3 years, recognising the uncertain environment and difficulties of predicting a more positive outcome at this stage.

The forecasts also include a minimum of \$5.5m capital investment per annum, consistent with the level of depreciation, to enable necessary reinvestment in equipment and infrastructure over time. We have sufficient actual and forecasted cash flows to meet business needs over the SCI period, dependent on the increase of activity levels in commercial revenue.

## COMMERCIAL VALUE

Section 16(3) of the CRI Act requires the Company to furnish an estimate of the current commercial value of the Crown's investment. We use net asset value as a proxy for the commercial value of the Group. The net asset position as shown in accordance with the Company's accounting policies for 30 June 2019 was \$34.6M.

## DIVIDEND POLICY

Our dividend policy states that the Company may elect to return surplus cash to shareholders in the form of a dividend when no sound investment opportunities exist (including reinvestment, commercialisation, capital expenditure, and the retention of important capabilities).

GNS Science is investing in people, systems and science infrastructure to enable delivery of its research strategies over the longer term. Therefore, no dividend is proposed in the short to medium term.

## COMPENSATION

Where the Crown wishes us to undertake activities or assume obligations that will result in a reduction of our profit or net worth, the Board will seek compensation sufficient to allow the organisation's position to be restored. No compensation is currently being sought from the Crown.

## GROUP RATIOS AND STATISTICS

Year ending 30 June	Forecast 2019/20	Outlook 2020/21	Outlook 2021/22	Outlook 2022/23
<b>Revenue</b>				
Total revenue (\$000s)	95,576	104,249	105,227	107,931
Revenue growth	0.5%	9%	1%	3%
<b>Operating results (\$000s)</b>				
Operating expenditure (excluding depreciation)	91,429	98,485	99,564	101,558
EBITDA	4,147	5,764	5,663	6,373
EBIT	(1,187)	264	163	873
Net profit/(loss) before tax	(787)	514	413	1,273
Net profit/(loss) after tax	(567)	370	297	917
EBITDA per FTE	10	13	13	13
Total assets	52,539	53,067	53,630	55,121
Total equity	33,997	34,367	34,665	35,582
Capital expenditure	5,921	7,784	5,500	5,500
<b>Liquidity</b>				
Quick ratio	2.2	2.0	2.0	2.1
Interest coverage	n/a	n/a	n/a	n/a
<b>Profitability</b>				
Return on equity	-1.6%	1.1%	0.9%	2.6%
Operating margin	4.3%	5.5%	5.4%	5.9%
<b>Operation risk</b>				
Profit volatility	37.0%	38.5%	13.3%	15.1%
Forecasting risk	3.2%			
<b>Growth/Investment</b>				
Capital renewal	1.1	1.4	1.0	1.0
<b>Financial strength</b>				
Equity ratio	64.7%	64.8%	64.6%	64.6%

# ACCOUNTING POLICIES

## Reporting entity and activities

The Institute of Geological and Nuclear Sciences Limited is established under the Crown Research Institutes Act 1992 and the Companies Act 1993. Its subsidiary companies are established under the Companies Act 1993. The financial statements have been prepared in accordance with the Crown Research Institutes Act 1992, the Public Finance Act 1989, the Companies Act 1993, the Crown Entities Act 2004 and the Financial Reporting Act 2013.

Consolidated financial statements for the group comprising the Institute of Geological and Nuclear Sciences Limited (the Company) and its subsidiaries are presented, and the effects of intra-group transactions are fully eliminated in the consolidated financial statements. Subsidiaries are those entities controlled by the Company.

Control is achieved where the Company has the power to govern the financial and operating policies of an entity to obtain benefits from its activities.

The subsidiaries of the Company are:

- Isoscan Limited
- Isoscan Food Limited
- Geological Surveys (New Zealand) Limited
- Geological Risk Limited
- GNS Science International Limited

The principal activities of the Group are to undertake geoscience and isotope science research, development and commercial projects, predominantly in New Zealand.

## Revenue

### STRATEGIC SCIENCE INVESTMENT FUND

The Company is party to a Strategic Science Investment Fund (SSIF) agreement with the Crown to perform research activities. Revenue under this contract is treated as a Government Grant under NZ IAS 20.

### REVENUE FROM OTHER RESEARCH AND COMMERCIAL CONTRACTS

Revenue earned from the supply of goods and services is measured at the fair value of consideration received. Revenue from services is recognised based on the percentage of work completed. Any amounts received in relation to work not yet commenced are recorded as revenue in advance. Revenue from the supply of goods is recognised when the significant risks and rewards of ownership of the goods have been transferred to the buyer. Revenue from other research and commercial contracts are accounted as revenue from contracts with customers under NZ IFRS 15.

## Property, plant and equipment

Property, plant and equipment are stated at cost less accumulated depreciation and impairment. Cost includes expenditure that is directly attributable to the acquisition of the item. Assets are depreciated on a straight-line basis at rates calculated to allocate the assets' cost over the estimated remaining useful lives. Freehold land is not depreciated.

The estimated useful lives, residual values and depreciation methods are reviewed annually, with the effect of any changes in estimate accounted for on a prospective basis. The gain or loss arising on the disposal or retirement of an item of property, plant and equipment is recognised in profit or loss.

### HERITAGE ASSETS – COLLECTIONS, LIBRARY AND DATABASES

The Company owns various collections, library resources and databases that are an integral part of the research work undertaken by the Company. These collections are highly specialised and there is no reliable basis for establishing a valuation. The two major collections are:

- The National Paleontological Collection
- The National Petrological Reference Collection.

## Intangible assets

Software, patents and capitalised development costs have a finite life and are included at cost less accumulated amortisation and impairment. Amortisation is charged on a straight-line basis at rates calculated to allocate the assets' cost over their estimated remaining useful lives.

The estimated useful life and amortisation method are reviewed annually, with the effect of any changes in estimate being accounted for on a prospective basis. The following useful lives are used in the calculation of amortisation:

- Software 4–8 years
- Patents 4–17 years
- Capitalised development costs 4–8 years.



## Deferred tax

Deferred tax is accounted for using the comprehensive balance sheet liability method in respect of temporary differences arising from differences between the carrying amount of assets and liabilities in the financial statements and the corresponding tax base of those items. In principle, deferred tax liabilities are recognised for all taxable temporary differences. Deferred tax assets are recognised to the extent that it is probable that sufficient taxable amounts will be available against which deductible temporary differences or unused tax losses and tax offsets can be utilised. The carrying amount of deferred tax assets is reviewed 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 assets to be recovered. Deferred tax assets and liabilities are measured at the tax rates that are expected to apply in the period in which the liability is settled or the asset realised.

Under Section OB1(2)(d) of the Income Tax Act (2007), the Company is not required to maintain an imputation credit account.

## Employee entitlements

Liabilities for wages and salaries, annual leave, long service leave and retirement leave are recognised when it is probable that settlement will be required, and they are capable of being reliably measured. Employee benefits to be settled within twelve months are reported at the amount expected to be paid and are classified as current liabilities. Employee benefits not expected to be settled within twelve months are reported at the present value of the estimated future cash outflows.

Provisions for long service leave and retirement leave depend on a number of assumptions such as the expected employment period of employees, salary levels and the timing of employees taking leave. When measuring employee benefit liabilities risk-free discount rates provided by The Treasury are used as the appropriate discount rates, the salary

increase factor is based on forecast information and employee pattern of leave has been determined after considering historical data.

In 2020, after taking actuarial advice, we adopted the standard model for leave valuation provided by The Treasury, which has resulted in a reduction in the provision, and consequently a reduction in leave expenses in the 2019-20 year.

## Financial instruments

### CAPITAL MANAGEMENT

The Group manages its capital to ensure that entities in the Group will be able to continue as going concerns while maximising the return to shareholders through the optimisation of the debt and equity balance. The capital structure of the Group consists of cash and cash equivalents, and equity attributable to equity holders of the parent, comprising issued capital and retained earnings. The Group is not subject to any externally imposed capital requirements.

### CURRENCY RISK

The Group undertakes certain transactions denominated in foreign currencies. Exchange rate exposures are managed within approved policy limits using forward foreign exchange contracts. These derivative financial instruments are initially recognised at fair value on the date the derivative contract is entered into and are subsequently remeasured to their fair value at the end of each reporting period. Derivatives are carried as assets when the fair value is positive and as liabilities when the fair value is negative. The resulting profit or loss is recognised in profit and loss immediately, unless the derivative is designated effective as a hedging instrument, in which event the timing of the recognition in profit or loss depends on the nature of the hedging relationship.

The effective portion of changes in the fair value of cash flow hedges is recognised in other comprehensive income and accumulated in a cash flow hedge reserve.

The gain or loss relating to any ineffective portion is recognised immediately in profit or loss.

### INTEREST RATE RISK

The Group operates a call account and has short-term deposits on which interest is earned. Where possible the Group manages exposures to interest rate fluctuations through prudent management of its treasury operations. In managing interest rate risks the Group aims to reduce the impact of short-term fluctuations on earnings. Over the longer term, however, permanent changes in interest rates will have an impact on profit.

### CREDIT RISK MANAGEMENT

The financial instruments which expose the Group to credit risk are principally bank balances, short-term investments and accounts receivable. The Group monitors credit risk on an ongoing basis. Bank balances and short term investments are held with New Zealand registered banks in accordance with the Group's treasury policy. No collateral is held by the Group in respect of bank balances, short-term investments or accounts receivable. The maximum exposure to credit risk is represented by the carrying value of each financial asset in the Balance Sheet.

### LIQUIDITY RISKS

The Group manages liquidity risk by maintaining adequate reserves, cash deposits and reserve borrowing facilities, by monitoring forecast and actual cash flows and matching the maturity profiles of financial assets and liabilities, all of which are of a short-term nature. The Group continues to generate sufficient cash flows from operations to meet financial liabilities.

## Trade and other payables

Trade and other payables are non-interest bearing and are normally settled no later than 20th of the month following invoice date. In recognition of the Government's requirements following the disruptions caused by Covid-19 to support the economy by ensuring prompt payment, we are now making payments weekly. The carrying value of creditors and other payables, approximates their fair value.

## Related party transactions

The Crown is the ultimate shareholder of the Company. No other transactions with New Zealand government owned entities are considered as related party transactions in terms of NZ IAS 24.

## Leases

GNS Science has adopted NZ IFRS 16 Leases during the financial year ended June 2020. Given that the value of leases is not material to the overall Balance Sheet, and the impact on profit and loss is negligible, we have reflected only the cumulative impact of existing lease commitments as at the date of application, without restatement of comparative periods.

## Preparation disclosures

### STATEMENT OF COMPLIANCE

The financial statements have been prepared in accordance with New Zealand generally accepted accounting practice. They comply with New Zealand equivalents to International Financial Reporting Standards and other applicable Financial Reporting Standards, as appropriate for profit oriented entities. The financial statements also comply with International Financial Reporting Standards.

Accounting policies are applied consistently to all periods presented in the financial statements unless otherwise stated.

### MEASUREMENT BASIS

The financial statements of the Group are prepared on an historical cost basis, except that derivative financial instruments are measured at their fair value. Transactions in foreign currencies are converted at the New Zealand rate of exchange ruling on the date of the transaction. Monetary assets and liabilities at year end are converted to New Zealand dollars at the exchange rate ruling at balance date. The financial statements are presented in New Zealand dollars which is the Group's functional currency. All values are rounded to the nearest thousand dollars.

### INTEREST IN JOINT ARRANGEMENTS

A joint arrangement is an arrangement whereby the Company or its subsidiaries have joint control over an entity. Joint control is the contractually agreed sharing of control of an arrangement, which exists only when decisions about the relevant activities of that entity require the unanimous consent of the parties sharing control. A joint arrangement is either a joint operation or a joint venture. For a joint operation the Group recognises its share of assets, liabilities, revenues and expenses on a line-by-line basis using the proportionate method. For a joint venture the Group recognises its interest in a joint venture as an investment and accounts for that investment using the equity method.

### CLASSIFICATION OF FINANCIAL ASSETS AND LIABILITIES

The Group holds loans and receivables. These are measured at cost less impairment, or in the case of trade receivables, reduced by an allowance for doubtful debts.

Financial liabilities, excluding derivative financial instruments, are classified as 'other financial liabilities'. Other financial liabilities are initially measured at fair value, net of transaction costs. Other financial liabilities are subsequently measured at amortised cost, with interest expense recognised on an effective interest basis.

### CRITICAL ACCOUNTING ESTIMATES AND JUDGEMENTS

In applying the accounting policies, there is the requirement for judgements, estimates and assumptions to be made about the carrying amounts of some assets and liabilities. The estimates and assumptions are based on historical experience and other relevant factors. Actual results may differ from these estimates.

Accounting policies where critical estimates have been made include property, plant and equipment, intangible assets, impairment of assets and liabilities, and employee benefits. Judgement has been applied in determining not to value heritage assets for financial reporting purposes.

### NEW STANDARDS AND INTERPRETATIONS NOT YET ADOPTED

New accounting standard NZ IFRS 16 Leases is effective in the current period and has been adopted.



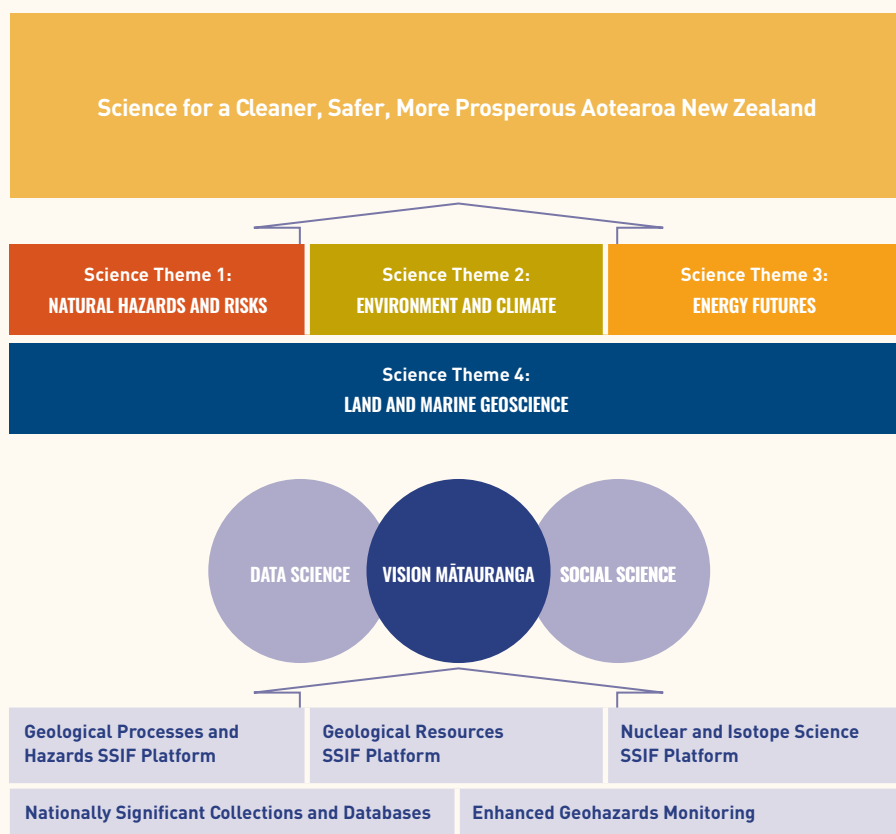
Dr Nicola Crauford  
Chairman



Sarah Haydon  
Deputy Chairman

# APPENDIX ONE

## ALIGNMENT OF SSIF INVESTMENT TO OUR VISION AND SCIENCE THEMES



# APPENDIX TWO

## GNS SCIENCE KEY PERFORMANCE INDICATORS

INDICATOR	MEASURE YEAR ENDING 30 JUNE	TARGET 2019-20	TARGET 2020-21
<b>STRATEGIC INTENT</b>			
<b>Priority setting</b>	Surveyed end-users have confidence that GNS Science considers their sector's priorities when setting their research priorities (%)	n/a	>70%
<b>Team selection</b>	Surveyed end-users have confidence that GNS Science has assembled 'best' teams for research delivery (%)	n/a	>85%
<b>SCIENCE IMPACT</b>			
<b>Research delivery</b>	Research milestones (critical steps) on track or completed	>85%	>87%
<b>Impact case studies</b>	Impact case studies published	3	3
<b>Knowledge transfer</b>	Surveyed end-users have adopted knowledge from GNS Science in the past three years (%)	n/a	>90%
<b>SCIENCE EXCELLENCE</b>			
<b>Peer-review</b>	Programme reviews carried out	5	3
<b>Science quality</b>	Impact of scientific publications (weighted citation index)*	3.0	3.2
<b>Research collaboration</b>	Papers co-authored with collaborators	91%	92%
<b>SCIENCE RELEVANCE</b>			
<b>End-user collaboration</b>	Revenue per FTE from commercial sources (\$000)	78	56
<b>Technology &amp; knowledge transfer</b>	Commercial reports per scientist FTE	2	1
<b>FINANCIAL</b>			
<b>Revenue generation</b>	Revenue per FTE (\$000)	244	228
<b>EMBEDDING VISION MĀTAURANGA</b>			
<b>Māori engagement</b>	Projects with Māori stakeholders embedded in the research	5	5
<b>HIGH PERFORMANCE CULTURE</b>			
<b>Health &amp; Safety</b>	Recordable injuries per 200,000 work hours (rolling 12-month average)	<3	<2.5
<b>Staff engagement**</b>	Percentage of staff engaged in working for GNS Science	65%	>68%

\* Mean 2-year impact factor for SCImago-assessed journals, weighted by the number of GNS Science publications.

\*\* Based on the Qualtrics Survey cluster of questions and definition for staff engagement.



# APPENDIX THREE

## OUR NATIONALLY SIGNIFICANT COLLECTIONS AND DATABASES

We are the custodian of eight Nationally Significant Collections and Databases. As well as ensuring that the databases and collections are kept up-to-date with newly acquired samples and data, we will maintain and improve system functionality and infrastructure to ensure ready access both internally and externally for research, commercial applications, and public information.

- The **Regional Geological Map Archive and Data File** is the national repository of geological maps and regional geological information for Aotearoa New Zealand and its territories, generated over the past 150 years by GNS Science and its predecessors. The information is used widely by resource companies, hazard and risk assessors, and land-use planners.
- The **National Petrology Reference Collection and PETLAB Database** is a curated archive of more than 100,000 rock and mineral samples from Aotearoa New Zealand and its territories collected since 1865. The samples and associated petrological data are used by mineral explorers and regional geologists to better understand crustal composition and resource prospectivity.
- The **NZ National Paleontological Collection and Associated Databases** is a collection of fossil samples from Aotearoa New Zealand and its territories dating back to the early 19th century. It includes vertebrate, invertebrate and plant macrofossils, animal and plant microfossils, trace fossils, and fossil-bearing rocks or rocks that have been sampled for microfossils. Together with the Fossil Record File, and a number of other paleontological databases, the collection provides key biostratigraphic data to refine geological time scale, with broad benefits to the resources industry, evolutionary biologists, paleo-ecologists and climate modellers. It also contains the raw data on past environmental change.
- The **NZ Fossil Record File** is a register of more than 100,000 fossil locations in Aotearoa New Zealand and the Ross Dependency described since 1865. The data provide essential information for biostratigraphic analysis and refinement of the geological time scale, which is used by stakeholders across the resources, geohazards and environment sectors.
- The **National Groundwater Monitoring Programme**, operating since 1998, provides water quality indicators, including major ions, nutrients, metals and arsenic, for groundwater sampled regularly in all 15 regions of Aotearoa New Zealand. The data provide critical information to water regulators, researchers and consultants to effectively manage water resources.
- The **National Earthquake Information Database** contains essential data on all significant earthquakes recorded in Aotearoa New Zealand since 1840. Accessed via the GeoNet website, these data are used extensively by earthquake hazard modellers and risk analysts, as well as insurance companies and CDEM agencies in Aotearoa New Zealand and overseas.
- The **NZ Volcano Database** is a collection of historic photos and discrete datasets that are being assembled under a single accessible portal. The data are used for eruption forecasting (Volcano Alert Levels), and research into magmatic and eruptive activity.
- The **NZ Geomagnetic Database** is a vehicle for transferring critical Southern Hemisphere geomagnetic data collected at Scott Base (Antarctica), West Melton (Canterbury) and Apia (Samoa) to the global INTERMAGNET database. The near real-time data plays an important role in constructing and testing global reference models of the geomagnetic field. Geomagnetic reference field models are widely used by scientists, by the military, in transport, and by the community in smartphones and other mobile devices to provide orientation information.

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NATIONALLY SIGNIFICANT  
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